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1995 SUPPLEMENTAL SUMMARY REPORT

1995 DATA VALIDATION AND EVALUATION REPORT

RECLAIMED ABANDONED AND INACTIVE MINES SCORING SYSTEM (RAIMSS)

VIDEO TAPE LOG

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Cascade County			
	Neihart	IXL/Eureka	07-083
		Cornucopia	07-147
		Ontario	07-148
		Benton/Big Snowy	07-151
		Lucky Strike	07-169
		Lower Black Diamond Jay	07-174
		Haystack Creek	07-179
Granite County			
	Combination	Combination II	20-009A
		Sunrise/Queen Millsite	20-036
	Philipsburg	Douglas Creek Waste Rock	20-503
	Princeton	Port Royal Mill Tailings	20-016
Jefferson County			
	Basin	Bullion Smelter	22-505
	Clancy	Frohner	22-243

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SUMMARY REPORT

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU

ABANDONED HARDROCK MINE PRIORITY SITES
1995
SUPPLEMENTAL SUMMARY REPORT

Prepared For:

Montana Department of Environmental Quality
Abandoned Mine Reclamation Bureau
1520 East Sixth Avenue
Helena, Montana 59620

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Engineering Services Agreement DEQ-AMRB No. 94-006

JUNE 1996

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located near Marysville, Montana.
This photograph was graciously provided by the
Montana Historical Society for use on this cover.

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	Hughesville	Carter	23-019	5-14
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1.0 INTRODUCTION

This document supplements the 1993 and 1994 Hazardous Materials Inventory Summary Report published by the Montana Department of Environmental Quality (formerly known as the Montana Department of State Lands)/Abandoned Mine Reclamation Bureau (MDEQ/AMRB). The Hazardous Materials Inventory was implemented to consistently characterize and rank the extent of environmental problems associated with the Abandoned Hardrock Mine Priority Sites. This 1995 supplemental report includes an additional 25 sites to the 332 sites inventoried in 1993 and 1994.

This report is organized into six sections. Section 1.0 presents the introduction, project objectives, a brief description of the project tasks, and a summary of the findings. Section 2.0 briefly describes field methods used during the inventory. Section 3.0 discusses data evaluation techniques and data management for the project. Section 4.0 presents a brief description of the Abandoned and Inactive Mines Scoring System (AIMSS) which was developed to rank the priority sites. Section 5.0 presents one page summaries for each of the priority sites. The summaries typically provide details about each site, such as volumes of wastes, contaminant concentrations, observed releases to surface water and groundwater, water quality criteria exceedances, and potential safety hazards. Section 6.0 presents the references cited in the text.

This Summary Report is supported by several other project documents and databases, including:

- The Sampling and Analysis Plan (SAP) presents the sampling approach for the Abandoned Mines Hazardous Materials Inventory. The SAP also contains instructions on completing the Inventory Form and the Standard Operating Procedures (SOPs) for conducting the field sampling activities (MDEQ/AMRB-Pioneer, 1994a).

- The Quality Assurance Project Plan (QAPjP) describes quality assurance procedures used for evaluating the field and lab data for the project (MDEQ/AMRB-Pioneer, 1994b).

- The Laboratory Analytical Protocol (LAP) describes laboratory requirements for the project (MDEQ/AMRB-Pioneer, 1994c).

- The Health and Safety Plan (HSP) describes practices and procedures to be followed by field investigators who performed the project to minimize exposure to hazardous materials and to eliminate any possibility of physical injury (MDEQ/AMRB-Pioneer, 1994d).

- The Abandoned Hardrock Mines Project Report is a compilation of the reports listed above, as well as this Summary Report, the AIMSS Report, the Data Validation/Evaluation Report, and the completed Hazardous Materials Inventory Forms for each site (MDEQ/AMRB-Pioneer, 1994e).

- The Abandoned Hardrock Mine Priority Sites, Hazardous Materials Inventory Databases.

The complete Abandoned Hardrock Mines Project Report, including the 1993 and 1994 inventories, can be viewed in Helena, Montana, at the Montana State Library; the MDEQ/AMRB office; or the MDEQ/Environmental Remediation Division (ERD; formerly known as the Montana Department of Health and Environmental Sciences/Solid and Hazardous Waste Bureau) office or in Missoula, Montana, at the United States Department of Agriculture/Forest Service (USFS), Region 1 office.

1.1 PROJECT OBJECTIVES

There are an estimated 6,000 abandoned or inactive hardrock mine and milling sites in Montana. This legacy of Montana's mining past has left a wide range of problems and challenges for the MDEQ/AMRB and other state and federal agencies charged with the reclamation and mitigation of these problems.

The problems associated with the abandoned and inactive hardrock mine sites are varied and range from safety hazards caused by hazardous mine openings, dangerous highwalls, and dilapidated structures, to threats to human and non-human life and the environment by mining waste containing elevated levels of heavy metals and other contaminants. To date, the MDEQ/AMRB has conducted a great deal of work to eliminate the problems of unsafe openings, highwalls, and structures, and has made over 1,500 of these sites safer.

In 1991, the MDEQ/AMRB concluded that substantial progress had been made in eliminating imminent hazards to public health and safety at abandoned hardrock mine sites. However, limited progress was realized with regard to the problems relating to heavy metal and mineral processing reagent contamination of surface water and groundwater. Not only were some of these sites causing severe environmental degradation, but they were also the sites of highest concern to the public. Additionally, the MDEQ/AMRB recognized that there were a number of other state and federal programs that had resources available to address their problems, but there was no coordinated approach to determining which specific sites should be addressed first. As a result, the MDEQ/AMRB solicited various state and federal agencies, requesting assistance in the identification of suspected problem sites. The following agencies responded to the MDEQ/AMRB request: USFS-Region 1, the United States Department of the Interior/Bureau of Land Management (BLM), MDEQ/ERD, and the

Montana Department of Natural Resources and Conservation (DNRC). A list of the 332 suspect sites was compiled from the input of these agencies supplemented by a review of existing data from the MDEQ/AMRB master inventory. This list included the majority of the highest potential hazard sites in Montana. These sites were investigated and inventoried during the 1993 and 1994 field seasons. As result of the 1993 and 1994 inventory activities and continued records searches, 25 additional sites were identified, investigated, and ranked during the 1995 field season by the MDEQ/AMRB. This 25-site supplement to the 1993 and 1994 priority sites list is presented in Table 1-1. The agencies previously listed agreed to a cooperative course of action, with MDEQ/AMRB designated as the lead agency. The agencies established the following objectives:

- to identify and prioritize those abandoned mine sites that are presently the most serious threats to public health and safety and the environment;
- to collect data on each priority site in a consistent manner to identify problems associated with each site and to directly compare and rank sites. All sampling and analysis methods will strictly follow United States Environmental Protection Agency (EPA) protocols to ensure consistent and accurate results; and
- to develop a long-term strategy to utilize statutory and financial resources available to systematically reduce the hazards associated with the prioritized abandoned mine sites.

Upon completion of this report, the first two objectives stated above are fulfilled, and the framework to complete the third objective is in place.

1.2 PROJECT DESCRIPTION

The additional 25 priority sites investigated during the 1995 field season under the Abandoned Mines Hazardous Materials Inventory were located in 7 counties and in 10 out of the 206 mining districts in Montana. Site investigations began September 14, 1995, and were completed on November 13, 1995. One field crew consisting of three to four scientists, engineers, and technicians were in the field for approximately 14 days to complete the data collection effort.

The site investigation conducted at each site involved the following tasks: overall site reconnaissance; mapping; collection of tailings, slag, waste rock, adit discharge, flooded shafts, stream water, and sediment samples; field analysis of solid matrix samples using an X-ray Fluorescence (XRF) Spectrometer; and measurements of field parameters in water, including flow rates, pH, specific conductance, temperature,

County	*District*	*Site Name*	*PA #*
Cascade	Neihart	IXL/Eureka	07-083
Cascade	Neihart	Cornucopia	07-147
Cascade	Neihart	Ontario	07-148
Cascade	Neihart	Benton/Big Snowy	07-151
Cascade	Neihart	Lucky Strike	07-169
Cascade	Neihart	Lower Black Diamond Jay	07-174
Cascade	Neihart	Haystack Creek	07-179
Granite	Combination	Combination II	20-009
Granite	Combination	Sunrise/Queen Millsite	20-036
Granite	Phillipsburg	Douglas Creek Waste Rock	20-503
Granite	Princeton	Port Royal Mill Tailings	20-016
Jefferson	Basin	Bullion Smelter	22-505
Jefferson	Clancy	Frohner	22-243
Judith Basin	Hughesville	Carter	23-019
Judith Basin	Hughesville	M.T.A.	23-040
Judith Basin	Hughesville	Belfont	23-060
Judith Basin	Hughesville	Sinclair	23-501
Judith Basin	Hughesville	May and Edna	23-502
Park	Big Timber Canyon	Stemwinder (South)	34-500
Powell	Emery	Emma Darling	39-027
Powell	Emery	Bonanza	39-501
Powell	Emery	Hidden Hand	39-502
Powell	Emery	Spring Creek	39-503
Sanders	Plains	S & H	45-017
Sweetgrass	Big Timber Canyon	Kelly	34-113

TABLE 1-1: 1995 ABANDONED MINE PRIORITY SITES

oxidation reduction potential, and alkalinity. The field team members also photographed sample locations and significant site features, video taped the site, and evaluated safety hazards.

The physical setting and topography associated with these sites ranged from gently sloping land in valley bottoms to very steep, high elevation, mountainous areas. Access to sites was often difficult due to poor road conditions or absence of maintained roads. Access to several sites was limited to travel on foot or by helicopter. Ownership of the priority sites is a mix of public lands (USFS, BLM, etc.) and patented lands (private ownership). The priority sites consist of primarily inactive/abandoned mine sites; however, exploration activities were in progress at a few of the sites.

Significant features at the sites included tailings ponds, impoundments, and piles; waste rock dumps or piles; mine openings, including adits, shafts, glory holes, and exploration trenches; miscellaneous buildings and structures; and roads. Mine opening discharges and streams adjacent to or flowing through the sites were common.

Hazardous materials observed at some of the sites included copper sulfate and a barrel full of an unknown liquid. Some of the sites support wildlife, domestic grazing, or aquatic life. Residential occupation of the sites was observed in rare cases, but residences located adjacent to the sites occurred more frequently.

1.3 SUMMARY OF FINDINGS

The following information is provided as an overview of the data compiled during the 1995 supplemental investigation to the Hazardous Materials Inventory.

Laboratory Sampling
- Total number of lab samples: 125 (does not include the QA/QC duplicates), representing approximately 2,019 data points generated by the laboratories.
- Total number of XRF samples: 375 (does not include the QA/QC duplicates), representing approximately 5,196 data points.

Waste Rock Associated with the 1995 Priority Sites
- Estimated total volume: 172,744 cubic yards.
- Estimated total area: 723,665 square feet (16.6 acres).
- Estimated total unvegetated/uncovered area: 556,691 square feet (12.8 acres).

Mill Tailings Associated with the 1995 Priority Sites
- Estimated total volume: 597,692 cubic yards.
- Estimated total area: 2,642,075 square feet (60.7 acres).
- Estimated unvegetated/uncovered area: 777,344 square feet (17.8 acres).

Slag Material Associated with the 1995 Priority Sites

- Estimated total volume: 737 cubic yards.
- Estimated total area: 1,100 square feet (0.2 acre).
- Estimated unvegetated/uncovered area: 1,100 square feet (0.2 acre).

Adit Discharges Associated with the 1995 Priority Sites

- Total number of discharging adits: 14.
- Number of adit discharges with pH ≤ 5.00: 2.
- Number of adit discharges with pH ≤ 6.00: 3.

Flooded Shafts Associated with the 1995 Priority Sites

- Total number of open shafts with water: 0.

Water Quality Criteria

- Number of discharges exceeding Safe Drinking Water Act MCL/MCLGs: 3.
- Number of adit discharges exceeding acute aquatic life criteria: 8.
- Number of adit discharges exceeding chronic aquatic life criteria: 9.
- Number of observed releases to surface water/sediment directly attributable: 9.
- Acute aquatic life exceedances in surface water: 12.
- Chronic aquatic life exceedences in surface water: 14.
- MCL exceedances in surface water attributable to the site: 7.

2.0 INVESTIGATION METHODS

2.1 DATABASE AND LITERATURE SEARCH

Data collected in the field was supplemented by an extensive literature search and the use of several computer databases. This supplemental information was used to complete the inventory forms and fulfill receptor information requirements for the AIMSS. The computer databases used to collect this information were:

- The Montana Bureau of Mines and Geology (MBMG) Well Logs Database, which was compiled by the MBMG and the DNRC. This database was used to estimate the number of wells within a one-and four-mile radius of each site.

- The Montana Rivers Information System (MRIS), Version 2.0, compiled by the Montana State Library for the Montana Department of Fish, Wildlife, and Parks (MDFWP). This database was used to assign classifications relating to riparian habitat quality, wetlands frontage, fisheries habitat and species classification, and sport fisheries classification for stream reaches potentially impacted by each site, where applicable.

- The MDEQ/Water Quality Bureau (WQB) - Community Water Supplies Database. The MDEQ/WQB provided a list of surface water resources presently used for drinking water supplies in Montana.

Additional information was obtained from the following sources:

- Peak and average stream flow estimates were obtained from United States Department of Interior/Geological Survey (USGS) flow monitoring reports on gaged streams.

- Population estimates were obtained by counting buildings delineated on the USGS quadrangle maps and USFS Forest Visitors Maps. Field observations supplemented this source of information.

- Land ownership was determined from USFS Forest Visitor Maps, unless more accurate records were available.

- Historic mine/millsite operations, mineralogy, and geology were obtained from several sources, including: United States Bureau of Mines (USBM) Circulars, USGS Bulletins and Professional Papers, and MBMG Memoirs, Bulletins, and Circulars.

- Historic analytical data were obtained from the MDEQ/AMRB project files, the MDEQ/ERD project files, the MDEQ/WQB, USFS project files, and MBMG data collected for the USFS. This data was reviewed prior to site visits to provide the investigators with background information on potential hazards associated with each site.

2.2 FIELD METHODS

A detailed discussion of specific investigation methodologies is found in the MDEQ/AMRB Hazardous Materials Inventory SAP (MDEQ/AMRB-Pioneer, 1994a). The purpose of this section is to describe some of the unique details of the investigative methods used to fulfill the project objectives.

The inventory form used during the 1995 investigation was almost identical to the 1994 form. The inventory form was used during the investigation to guide and focus the investigative tasks to ensure consistent evaluation of each site. Literature and database searches were performed prior to the field investigations to provide investigators with background information on each site.

Sampling was performed on waste rock dumps, mill tailings, streams, ponds, adit discharges, and from domestic groundwater wells or monitoring wells, when present.

Each mill tailings deposit was characterized both spatially and vertically by hand-auguring to determine accurate depths and delineate stratification or differences in metals concentrations between the upper oxidized zone(s) and the lower reduced zones. Subsamples were collected from each visually distinct strata.

Typically, several subsamples were collected from each waste rock dump in order to better characterize these very heterogeneous waste sources. Subsamples from the tailings and waste rock were analyzed in the field using XRF Spectrometers. The field screening data allowed the investigators to make informed decisions on the number of samples required for laboratory analyses and indicated how best to composite the subsamples from the potential sources in order to send representative samples to the laboratory, while minimizing the number of samples to achieve this end. The XRF analyses also provided an increased number of valid and discrete data points per site achieving a more thorough understanding of the problems associated with each site. Solids were characterized additionally by field measurement of pH and radioactivity.

Stream sediment samples were also analyzed in the field with the XRF in order to assist in the assessment the extent of contamination and migration from the waste sources.

Surface water sampling was often conducted to characterize impacts to drainage basins, as well as contributions from individual sites, when multiple sources were present. Waters were additionally characterized in the field by measuring flow rates, pH, specific conductance, alkalinity, and temperature.

Site mapping was conducted using a Global Positioning System supplemented with standard "Chain and Compass" surveying techniques when necessary. The primary purpose of mapping was to estimate volume and area of waste sources and record sample locations. Other significant site features, such as streams or drainages, roads, mine openings, and structures, were also recorded on the site sketches. Sample locations and other significant site features were documented on photographic slides and video tape to assist the resource managers in their evaluation of the priority sites.

3.0 DATA EVALUATION AND COMPARISONS

The purpose of this section is to discuss data quality validation and evaluation, as well as comparisons of the data to pertinent criteria.

3.1 DATA VALIDATION AND EVALUATION

3.1.1 Laboratory Data Validation and Evaluation

The laboratory utilized during this investigation complied all of the QA/QC performance requirements defined in the Contract Laboratory Program (CLP) Statement of Work (SOW, March 1990). The data packages provided by the laboratory allowed comprehensive data validation and evaluation procedures to be completed. Laboratory data validation and evaluation were performed according to guidelines developed by the EPA.

The laboratory data were validated in accordance with the document Laboratory Data Validation Functional Guidelines for Evaluating Inorganics (EPA, 1988). The data validation procedures were performed partially by laboratory chemists and partially by a data reviewer from Pioneer Technical Services, Inc. The data validation procedure included an evaluation of the following:

- holding times;
- initial and continuing calibrations;
- calibration and preparation blanks;
- inductively coupled plasma (ICP) interference check samples;
- laboratory control samples (LCS);
- laboratory duplicate sample analyses (precision assessment);
- matrix spike sample analyses (accuracy assessment);
- furnace atomic absorption (AA) quality control;
- ICP serial dilutions;
- sample result verification;
- field blank analyses; and
- overall assessment of data for the case.

Data evaluation occurred after the data validation process was completed and the appropriate qualifiers had been applied to the data. The data evaluation process involved a statistical analysis of the data to identify outliers and assess the quality of the data overall. Data evaluation was performed on the laboratory data which met the Data Quality Objectives (DQOs) outlined in the QAPjP for the Abandoned Mines Hazardous Materials Inventory (MDEQ/AMRB-Pioneer, 1994b).

Although numerous qualifications (flags) were applied to the laboratory data compiled during this investigation, and a small portion of the data were evaluated as outliers, none of the data were flagged "R" or were otherwise considered unusable. Consequently, 100 percent of the laboratory data (soil and water) collected during this investigation are considered valid and useable for all of the objectives of this project.

The limitations of the data should be considered when making interpretations. Please refer to the document entitled Data Validation and Evaluation Report for the Abandoned Mines Hazardous Materials Inventory for a detailed description of the procedures followed and results provided by the overall data assessments.

3.1.2 X-Ray Fluorescence Spectrometer Data Validation

Data provided by the field portable XRF Spectrometer were also validated; the XRF data were validated according to manufacturer specifications. The validation procedures for XRF data were not as rigorous as for laboratory data; consequently, additional procedures, utilizing standard statistical techniques, were employed to evaluate the overall quality of the XRF data. These additional procedures included assessment of XRF duplicate data to quantify precision, as well as comparing XRF data to corresponding laboratory data to assess inter-method precision and correlation.

3.1.3 Other Field Measurements

Field parameter measurements, such as pH, Eh, and specific conductance, were not evaluated for data quality. SOPs (MDEQ/AMRB-Pioneer, 1994a) were carefully followed in the field to achieve a consistent and acceptable level of quality.

3.2 DATA INTERPRETATION

The analytical data collected was compared to site-specific background or upgradient concentrations, as well as drinking water standards and aquatic life criteria. The following sections explain how these comparisons were made.

3.2.1 Background Soil Comparison

Background soil samples were collected to establish the extent to which metals concentrations were elevated in comparison to the local background. Constituents present at concentrations greater than three times background concentrations were considered "attributable" to the site. Background samples were typically applied to groups of sites in close proximity to one another and within similar geologic units. Occasionally, background samples collected during the 1993 and 1994 investigations were used.

3.2.2 Observed Releases to Groundwater, Surface Water, and Sediment

An observed release to surface water is defined as a downstream surface water or stream sediment sample concentration at more than three times the upstream surface water or sediment sample concentration, for any constituent that can be attributed to the site. Groundwater, surface water, and stream sediment analytical data were used to document observed releases from the priority sites.

3.2.3 MCL/MCLG, Aquatic Life Criteria Comparisons

Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) are drinking water standards promulgated under the federal Safe Drinking Water Act (SDWA; 40 CFR Parts 141, 143). MCLs, and MCLGs apply to public water systems; however, they may be relevant and appropriate to surface or groundwater if those waters are used as drinking water. Groundwater and surface water metals concentrations observed in samples collected were evaluated against these standards. The current SDWA MCLs and MCLGs expressed in micrograms per liter (μg/L) are:

Arsenic: 50 μg/L
Copper: 1,300 μg/L
Nickel: 100 μg/L
Cyanide: 200 μg/L
Barium: 2,000 μg/L
Chromium: 100 μg/L
Antimony: 6 μg/L
Cadmium: 5 μg/L
Mercury: 2 μg/L
Lead: 15 μg/L*

*Not an MCL, but an action level.

Surface water and mine discharge analytical results were also evaluated against the freshwater acute and chronic aquatic life criteria as presented in the Montana Numeric Water Quality Standards, Circular WQB-7, July 15, 1995. Some of these criteria are expressed as a function of total hardness and were corrected for the hardness measured in each sample, when applicable.

3.3 DATA MANAGEMENT

The data collected under this project has been input into the data manager dBase IV, Version 2.0. Four files were created to contain the data and aid in any manipulation of the data that may be desired. These files are summarized briefly below.

- PTSDATA.DBF contains field data collected for each sample during the Hazardous Materials Inventory;
- XRFDATA.DBF contains all the XRF analytical results generated in the field during the Hazardous Materials Inventory;

- LABDATA.DBF contains the data from all of the laboratory analyses performed during the Hazardous Materials Inventory; and
- PRIORITY.DBF is the modified dBase file provided to Pioneer by MDEQ/AMRB from the master inventory.

The information from these four files can be readily combined with one another to form a relational database.

4.0 SITE RANKING

The final task of the Hazardous Materials Inventory involved the development of a system to rank the severity of hazards or environmental threats associated with the sites investigated in order to assist the MDEQ/AMRB in prioritizing reclamation efforts and allocation of resources. This system, the Abandoned and Inactive Mines Scoring System (AIMSS), closely follows the EPA's Hazard Ranking System, although the AIMSS is specifically focused on potential hazards typically associated with the abandoned or inactive hardrock mines.

The AIMSS also evaluated potential safety hazards associated with the sites such as hazardous mine openings, highwalls, and structures, and generated a separate safety score for each site. The AIMSS utilized the data collected for each site to assign a ranking score.

The AIMSS is focused towards the physical site setting and potential hazards associated with abandoned and inactive mines due to its capability to evaluate mine opening discharges and large quantities of mine wastes. The AIMSS scoring method evaluates relative risks between sites. This accounts for site-specific contaminant concentrations and the varying toxicity of different constituents, as well as adit discharges in the source evaluation. This method more effectively discriminates between sites with higher concentrations or more toxic constituents in relation to sites with lower concentrations or less toxic constituents. In order to generate an overall Mine Site Human Health and Environmental Hazard Score, the AIMSS evaluates the groundwater pathway, surface water pathway, air pathway, and direct contact pathway. Under each pathway, the AIMSS evaluates observed releases, potential to release, pathway characteristics, waste characteristics, and targets.

Table 4-1 lists the 1995 supplemental priority sites and their associated AIMSS score, sorted in descending order. The necessary data for ranking each of the 1995 inventory sites was collected.

The AIMSS also generates a distinct safety score for each site by evaluating site accessibility and safety hazards present (i.e., shafts, stopes, open adits, hazardous structures, and explosives/other hazardous materials or chemicals). Table 4-2 lists the 1995 supplemental priority sites and their associated safety score, sorted in descending order.

1995 RANK	County	District	Site Name	PA #	AIMSS SCORE
1	Granite	Combination	Combination II	20-009A	99.32
2	Powell	Emery	Spring Creek Tailings	39-503	28.13
3	Jefferson	Clancy	Frohner	22-243	22.68
4	Granite	Phillipsburg	Douglas Creek Waste Rock	20-503	14.10
5	Powell	Emery	Hidden Hand	39-502	6.53
6	Cascade	Neihart	Benton/Big Snowy	07-151	2.67
7	Cascade	Neihart	Lower Black Diamond Jay	07-174	2.06
8	Powell	Emery	Bonanza	39-501	1.20
9	Cascade	Neihart	Haystack Creek	07-179	1.18
10	Judith Basin	Hughesville	Carter	23-019	1.14
11	Powell	Emery	Emma Darling	39-027	1.07
12	Cascade	Neihart	Cornucopia	07-147	1.00
13	Cascade	Neihart	IXL/Eureka	07-083	0.84
14	Judith Basin	Hughesville	Sinclair	23-501	0.77
15	Granite	Princeton	Port Royal Mill Tailings	20-016	0.64
16	Judith Basin	Hughesville	Belfont	23-060	0.40
17	Judith Basin	Hughesville	M.T.A	23-040	0.36
18	Sanders	Plains	S & H	45-017	0.29
19	Judith Basin	Hughesville	May and Edna	23-502	0.25
20	Granite	Combination	Sunrise/Queen Millsite	20-036	0.22
21	Park	Big Timber Canyon	Stemwinder (South)	34-500	0.16
22	Jefferson	Basin	Bullion Smelter	22-505	0.11
23	Cascade	Neihart	Lucky Strike	07-169	0.06
24	Sweetgrass	Big Timber Canyon	Kelly	34-113	0.03
25	Cascade	Neihart	Ontario	07-148	0.01

TABLE 4-1: 1995 ABANDONED HARDROCK MINES PRIORITY SITES AMISS RANKING

1995 RANK	County	District	Site Name	PA #	SAFETY SCORE
1	Powell	Emery	Hidden Hand	39-502	145.60
2	Powell	Emery	Emma Darling	39-027	76.80
3	Sanders	Plains	S & H	45-017	75.00
4	Powell	Emery	Bonanza	39-501	67.20
5	Judith Basin	Hughesville	Sinclair	23-501	45.00
6	Cascade	Neihart	Haystack Creek	07-179	44.00
7	Judith Basin	Hughesville	M.T.A	23-040	42.00
8	Granite	Combination	Sunrise/Queen Millsite	20-036	30.80
9	Granite	Phillipsburg	Douglas Creek Waste Rock	20-503	24.60
10	Cascade	Neihart	Lucky Strike	07-169	23.70
11	Judith Basin	Hughesville	Carter	23-019	19.80
12	Jefferson	Basin	Bullion Smelter	22-505	18.40
13	Jefferson	Clancy	Frohner	22-243	7.80
14	Cascade	Neihart	IXL/Eureka	07-083	7.40
15	Cascade	Neihart	Cornucopia	07-147	6.90
16	Cascade	Neihart	Lower Black Diamond Jay	07-174	2.55
17	Cascade	Neihart	Benton/Big Snowy	07-151	1.90
18	Judith Basin	Hughesville	Belfont	23-060	1.25
19	Cascade	Neihart	Ontario	07-148	1.15
20	Sweetgrass	Big Timber Canyon	Kelly	34-113	1.00
21	Park	Big Timber Canyon	Stemwinder (South)	34-500	1.00
22	Powell	Emery	Spring Creek Tailings	39-503	0.00
23	Granite	Princeton	Port Royal Mill Tailings	20-016	0.00
24	Judith Basin	Hughesville	May and Edna	23-502	0.00
25	Granite	Combination	Combination II	20-009A	0.00

TABLE 4-2: 1995 ABANDONED HARDROCK MINES PRIORITY SITES SAFETY RANKING

5.0 SITE SUMMARY FORMS

The following section presents a one page summary sheet for each of the 25 sites investigated during the 1995 inventory. Each summary sheet provides the site name, location, and other geographic information; and investigation details and summary of findings. Analytical data obtained at each site is summarized on the back of each summary sheet.

SAMPLE DESIGNATION LEGEND

GW: Groundwater sample from well, spring, shaft, or adit discharge.

SW: Surface water sample from stream, river, or ditch.

AD: Adit discharge.

SE: Stream sediment sample.

TP: Mill tailings sample from tailings pond or pile, or streamside tailings deposit.

WR: Waste rock sample from waste rock dump.

SS: Background soil sample.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: IXL/Eureka
Legal Description: T 14N R 8E
Mining District: Neihart
Latitude: N 46° 57' 18"
Longitude: W 110° 42' 43"
Land Status: Private
Quad: Neihart
Inspectors: Tuesday, Flammang, Sampson
Organization: Pioneer Technical Services, Inc.

County: Cascade
Section(s): NW 1/4, NE 1/4, Section 28
Mine Type: Hardrock/Ag, Pb, Zn
Primary Drainage: Belt Creek
USGS Code: 10030105
Secondary Drainage: Snow Creek/Carpenter Creek
Date Investigated: September 24, 1995
P.A. # 07-083

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 3,575 cubic yards. WR-3 was situated in an intermittent stream bed. The following elements were elevated at least three times background:
  Antimony: 68.2J mg/kg
  Arsenic: 36 to 97.7 mg/kg
  Cadmium: 6.5J to 7J mg/kg
  Copper: 33.4JX to 59.9 mg/kg
  Iron: 83,700 mg/kg
  Lead: 2,880 to 3,130 mg/kg
  Mercury: 0.48 to 4.3 mg/kg
  Silver: 27.6 to 45.2 mg/kg
  Zinc: 581 to 1,590J mg/kg

- One discharging adit was observed at the site which flowed over and along the west side of WR-3. No MCLs were exceeded in the adit water sample, but acute and chronic aquatic life criteria were exceeded for zinc, and the chronic aquatic life criteria was exceeded for aluminum, cadmium, and lead. The pH of the adit discharge was 6.38.

- No surface water flowed on or near the site during the investigation. The nearest flowing surface water was over 1,000 feet away; no surface water samples were collected.

- An observed release to the intermittent drainage (sediment) was documented for silver, which is directly attributable to the site.

- Potential safety hazards observed at the site included three open adits, one fenced open shaft, three shaft/subsidence structures, a highwall, and two unstable waste piles.

I.X.L./ EUREKA (all 4 sites) PA# 07-083
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/24/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
07-083-SE-1	5.4 UJ	29.3 J	44.4	9.2	1590	15.6	7.2	72.6	38300	428 JX	3800 J	1660	0.055	12.8	8 8	1450	NR
07-083-SE-2	4.9 UJ	43.7 J	95.4	20.8	2680	17.5	12.2	55.2	25400	681 JX	7360 J	4250	0.049	27.4	1.1	2500	NR
07-083-WR-1	68.2 J	36.0	15.0	7.0 J	19.3	1.6 U	1.8 U	59.9	9810	2880	56.8	25.6	4.3	2 3 U	45.2	1590 J	NR
07-083-WR-3	6.3 UJ	97.7	16.6 J	6.5 J	35900	2.0 U	2 2 U	33.4 JX	83700	3130	46.2	12 5	0.48	2.8 U	27.6	581	NR
BACKGROUND	4.7 UJ	9.6	87.6	1.32 JX	NR	27.2 J	9.05 J	10.8 J	21100	52.4 JX	NR	708 J	0.04	10.3	0 5 B	135	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
07-083-WR-1	0.29	9.06	-1.33	-10.4	0.18	0.01	0.10	0.31	-1.64	-1.64	-3.44	7.66	-11.23	-23.59
07-083-WR-3	9.09	284	-6.56	-291	0.15	1.62	7.32	50.6	-57.20	-57.20	-120.12	282.89	-361.81	-759.81

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Al (ug/L)	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
07-083-AD-1	103 JX	2.7 UJ	1.2 U	4.8 U	1.1	18500	9.6 U	10.9 U	4.4 U	709	3.5	3700	99.4	0.16 U	17.7	0.21 U	340	61.5

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
07-083-AD1	103	< 5	40.0	NR	NR

Legend

SE-1- Immediately below WR-3.
SE-2- Upstream above WR-1 & WR-3.
WR-1- Composite WR1A, 1B, 2A, 2B, 4A, 4B.
WR-3- WR-3.
BACKGROUND- From the Ripple (07-163-SS1) (1994 data).
AD-1- Adit at WR-3.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Cornucopia	County: Cascade
Legal Description: T 14N R 8E	Section(s): SW 1/4, SE 1/4, Section 22
Mining District: Neihart	Mine Type: Hardrock/Ag, Pb, Zn
Latitude: N 46° 57' 17"	Primary Drainage: Belt Creek
Longitude: W 110° 41' 27"	USGS Code: 10030105
Land Status: Private	Secondary Drainage: Snow Creek/Carpenter Creek
Quad: Neihart	
Inspectors: Tuesday, Flammang	Date Investigated: September 25, 1995
Organization: Pioneer Technical Services, Inc.	P.A. # 07-147

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock observed at the site was approximately 8,475 cubic yards. Waste rock was located in a drainage. The following elements were elevated at least three times background:

Arsenic: 58.9 to 184 mg/kg	Lead: 194 to 723 mg/kg
Mercury: 0.22 to 0.33 mg/kg	Silver: 4.6 to 58.8 mg/kg
Zinc: 559 mg/kg	

- One discharging adit was observed at the site which flowed over and through WR-2. Field parameters were taken with a pH of 7.99. A previously collected sample of the discharge exceeded acute and chronic aquatic life criteria for copper and zinc, and the sample exceeded chronic aquatic life criteria for lead and iron.

- An intermittent unnamed tributary to Snow Creek flowed adjacent and through WR-2 during the investigation. Acute and chronic aquatic life criteria were exceeded for zinc and cadmium, while lead exceeded the chronic aquatic life criteria. The MCL for cadmium was exceeded.

- An observed release to the tributary via sediment was documented for arsenic, lead, and silver.

- Potential safety hazards observed included two partially collapsed buildings, a large pit with collapsed shaft, a collapsed adit with a 25 foot highwall, and two unstable waste piles.

Cornucopia PA# 07-147
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/25/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
07-147-SE-1	5.4 UJ	5.77	46.1 J	1.4 J	2570	16.0	12.4	15.5 JX	23000	30.0	4860	492	0.043 U	14.7	0.8 U	102	NR
07-147-SE-2	6.3 UJ	35.8	57.8 J	2.3 J	2370.0	8.9	6.8	17.9 JX	20300	124	1980	365	0.050 U	6.7	8.0	228	NR
07-147-WR-1	5.9 UJ	184	78.2 J	3.1 J	947	5.2	4.3	28.4 JX	49600	723	1890	163	0.33	5.4	58.8	559	NR
07-147-WR-2	5.7 UJ	58.9	53.0 J	2.2 J	2460	11.7	5.0	25.9 JX	23900	194	1770	278	0.22	8.2	4.6	217	NR
BACKGROUND	4.7 UJ	9.6	87.6	1.32 JX	NR	27.2 J	9.05 J	10.8 J	21100	52.4 JX	NR	708 J	0.04	10.3	0.5 B	135	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
07-147-WR-1	0.26	8.12	-3.88	-12.0	0.24	<0.01	0.02	0.00	-3.88	-3.88	-8.15	6.25	-12.66	-26.59
07-147-WR-2	0.10	3.12	1.37	-1.76	0.05	0.05	<0.01	1.56	-0.19	-0.19	-0.40	2.73	-1.71	-3.58

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
07-147-SW-1	2.7 U	1.8 U	24.2	7.5	22700	9.6 U	10.9 U	4.4 U	29.2	1.8 JX	7780	18.0 J	0.16 U	13.9 U	0.21 UJX	2450	88.8
07-147-SW-2	2.7 U	2.0	11.8	4.4	11700	9.6 U	10.9 U	4.4 U	32.8	2.2 JX	3800	5.2 UJ	0.16 U	13.9 U	0.45 JX	1150	44.8
CC-GW-7	45.9 U	2.3 U	12	3.1 U	14800	2.8 U	4.3 U	16.4	1290.0	11.7	4620	111	0.1 U	14.2 U	2.20 U	107	56.0

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
07-147-SW-1	98	< 5	77	NR	NR
07-147-SW-2	46	< 5	36	NR	NR

Legend

SE-1- 20' below road.
SE-2- 175' below base of WR2 where stream reappears.
WR-1- Composite WR1A, 1B, 1C.
WR-2- Composite WR2A, 2B, 2C.
BACKGROUND- From the Ripple (07-163-SS1) (1994 data).
SW-1- Same as SE-1.
SW-2- Same as SE-2.
CC-GW-7- Adit discharge (GW1 on sketch)

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Ontario	County: Cascade
Legal Description: T 14N R 8E	Section(s): NW 1/4, NE 1/4, Section 27
Mining District: Neihart	Mine Type: Hardrock/Ag, Pb, Zn
Latitude: N 46° 57' 00"	Primary Drainage: Belt Creek
Longitude: W 110° 41' 32"	USGS Code: 10030105
Land Status: Private	Secondary Drainage: Snow Creek/Carpenter Creek
Quad: Neihart	
Inspectors: Tuesday, Flammang	Date Investigated: September 25, 1995
Organization: Pioneer Technical Services, Inc.	P.A. # 07-148

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock observed at the site was approximately 975 cubic yards. The waste rock was adjacent to the adit discharge. The following elements were elevated at least three times background:

Arsenic: 145 mg/kg	Cadmium: 13J mg/kg
Copper: 35.4JX mg/kg	Lead: 347 mg/kg
Manganese: 3,090 mg/kg	Mercury: 0.15 mg/kg
Zinc: 948 mg/kg	

- One discharging adit was observed at the site which flowed adjacent to the waste rock. No MCLs or chronic aquatic life criteria were exceeded; however, the acute aquatic life criteria was exceeded for silver. The pH was 6.5.

- No surface water flowed on or near the site during the investigation. The nearest surface water was over 1,000 feet away; no surface water samples were collected.

- Potential safety hazards observed included a small shed and highwall at the caved adit.

Ontario PA# 07-148
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/25/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
07-148-WR-1	6.9 UJ	145	59.6 J	13.0 J	6380	19.1	25.5	35.4 JX	42100	347	2820	3090	0.15	52.9	1.2	948	NR
BACKGROUND	4.7 UJ	9.6	87.6	1.32 JX	NR	27.2 J	9.05 J	10.8 J	21100	52.4 JX	NR	708 J	0.04	10.3	0.5 B	135	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
07-148-WR-1	0.49	15.3	14.0	-1.33	0.03	0.20	0.26	6.25	7.73	7.73	16.23	15.08	-1.35	-2.83

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
07-148-AD-1	2.7 U	1.8 U	7.0	0.10	8360	9.6 U	10.9 U	4.4 U	139	1.3 UX	2540	19.1 J	0.16 U	13.9 U	1.4 JX	7.6 U	31.3

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
07-148-AD-1	12	< 5	< 5	NR	NR

Legend

WR-1- Composite WR1A and WR1B.
BACKGROUND- From the Ripple (07-163-SS1) (1994 data).
AD-1- Adit discharge above road and WR1.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Benton/Big Snowy	County: Cascade
Legal Description: T 14N R 8E	Section(s): SW 1/4, NW 1/4, Section 27
Mining District: Neihart	Mine Type: Hardrock/Pb, Ag, Au
Latitude: N 46° 56' 44"	Primary Drainage: Belt Creek
Longitude: W 110° 42' 04"	USGS Code: 10030105
Land Status: Private	Secondary Drainage: Snow Creek/Carpenter Creek
Quad: Neihart	
Inspectors: Tuesday, Flammang	Date Investigated: September 25, 1995
Organization: Pioneer Technical Services, Inc.	P.A. # 07-151

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 9,250 cubic yards. Waste rock was situated in a intermittent drainage. The following elements were elevated at least three times background:

Antimony: 22.1 to 28.9 mg/kg	Arsenic: 95.4 to 160 mg/kg
Cadmium: 22.6J mg/kg	Lead: 3,210 to 3,560 mg/kg
Copper: 65.6 to 169 mg/kg	Silver: 50.7 to 60.4 mg/kg
Mercury: 0.36 to 0.48 mg/kg	Zinc: 5,000J mg/kg

- There were no discharging adits, filled shafts, seeps, or springs observed at the site during the investigation.

- No surface water flowed on or near the site during the investigation. The nearest flowing surface water was over 1,000 feet away; no surface water samples were collected.

- Observed releases to the intermittent drainage (sediment) were documented for cadmium and zinc, which were directly attributable to the site.

- Potential safety hazards observed at the site included a small wood building and two unstable collapsed adit trenches.

Benton/ Big Snowy (2 sites) PA# 07-151
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/25/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
07-151-SE-1	9.8 J	99.6	68.9	12.4 J	2030	8.0	5.5	57.8	27600	1650	2680	833	0.14	5.9	28.3	2810 J	NR
07-151-SE-2	6.8 UJ	110	423	2.1 J	1450	14.7	4.9	136	26100	2090	3650	558	0.38	8.6	58.2	596 J	NR
07-151-WR-1	28.9 J	95.4	16.9	22.6 J	184	3.0	1.7 U	65.6	15300	3210	314	69	0.48	2.2 U	50.7	5000 J	NR
07-151-WR-3	22.1 J	160	69.1	1.7 J	2470	4.8	2.0 U	169	26700	3560	684	91.3	0.36	2.9	60.4	361 J	NR
BACKGROUND	4.7 UJ	9.6	87.6	1.32 JX	NR	27.2 J	9.05 J	10.8 J	21100	52.4 JX	NR	708 J	0.04	10.3	0.5 B	135	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Request

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
07-151-WR-1	0.58	18.1	-1.53	-19.6	0.35	0.08	0.15	2.50	-4.03	-4.03	-8.46	15.39	-21.15	-44.42
07-151-WR-3	0.90	28.1	-21.92	-31.0	0.86	<0.01	0.04	0.00	-2.92	-2.92	-6.13	21.41	-54.16	-113.74

Legend

SE-1- Downstream of site, 50' below WR1.
SE-2- Upstream of site, 30' above WR3.
WR-1- Composite of WR1, 2A, 2B.
WR-3- Composite of WR3A, WR3B.
BACKGROUND- From the Ripple (07-163-SS1) (1994 data).

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Lucky Strike
Legal Description: T 14N R 8E
Mining District: Neihart
Latitude: N 46° 56' 57"
Longitude: W 110° 42' 55"
Land Status: Private
Quad: Neihart
Inspectors: Tuesday, Flammang, Sampson
Organization: Pioneer Technical Services, Inc.

County: Cascade
Section(s): SE 1/4, NW 1/4, Section 28
Mine Type: Hardrock/Ag, Pb, Zn
Primary Drainage: Belt Creek
USGS Code: 10030105
Secondary Drainage: Snow Creek/Carpenter Creek
Date Investigated: September 24, 1995
P.A. # 07-169

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 2,400 cubic yards. Waste rock was in the direct path of the adit discharge. The following elements were elevated at least three times background:
  Antimony: 32.1J mg/kg
  Arsenic: 61.6 mg/kg
  Cadmium: 6.2J mg/kg
  Copper: 224 mg/kg
  Lead: 954 mg/kg
  Manganese: 3,000 mg/kg
  Mercury: 0.94 mg/kg
  Silver: 59.1 mg/kg
  Zinc: 1,200J mg/kg

- One discharging adit was observed at the site which flowed over and along the waste rock. Acute and chronic aquatic life criteria were exceeded for copper and zinc, and no MCLs were exceeded. The pH was 7.98.

- No surface water flowed on or near the site during the investigation. The nearest surface water was over 1,000 feet away; no surface water samples were collected.

- Potential safety hazards observed at the site included one partially open adit, a metal shed, two loadouts, and three highwalls.

Lucky Strike PA# 07-169
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/24/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
07-169-WR-1	32.1 J	61.6	46.9	6.2 J	2230	11.5	11.2	224	37100	954	3070	3000	0.94	10.3	59.1	1200 J	NR
BACKGROUND	4.7 UJ	9.6	87.6	1.32 JX	NR	27.2 J	9.05 J	10.8 J	21100	52.4 JX	NR	708 J	0.04	10.3	0.5 B	135	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
07-169-WR-1	0.55	17.2	2.83	-14.4	0.20	0.07	0.28	2.19	0.64	0.64	1.34	15.63	-15.99	-33.59
07-169-WR-1 DUP	0.55	17.2	3.23	-14.0	0.21	0.05	0.29	1.56	1.67	1.67	3.51	15.55	-15.40	-32.33

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Al (ug/L)	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
07-169-AD-1	172 JX	4.4 J	2.0	8.6	0.91	29900	10.7	10.9 U	21.3	665	6.8	10500	811	0.16 U	13.9 U	1.3	135	118

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
07-169-AD-1	159	< 5	51	NR	NR

Legend

WR-1- Composite of WR1A, 1B, 2A, 2B, 3
BACKGROUND- From the Ripple (07-163-SS1) (1994 data).
AD-1- Adit at WR-2.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Lower Black Diamond Jay
Legal Description: T 14N R 8E
Mining District: Neihart
Latitude: N 46° 57' 18"
Longitude: W 110° 42' 00"
Land Status: Private
Quad: Neihart
Inspectors: Tuesday, Flammang, Liebelt
Organization: Pioneer Technical Services, Inc.

County: Cascade
Section(s): SW 1/4, SW 1/4, Section 22
Mine Type: Hardrock/Ag, Pb, Zn
Primary Drainage: Belt Creek
USGS Code: 10030105
Secondary Drainage: Snow Creek/Carpenter Creek
Date Investigated: September 27, 1995
P.A. # 07-174

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 1,875 cubic yards. Waste rock was located in the drainage of an unnamed tributary of Snow Creek. The following elements were elevated at least three times background:
  Arsenic: 223 mg/kg
  Copper: 66.2 mg/kg
  Lead: 8,590 mg/kg
  Mercury: 0.47 mg/kg
  Silver: 12.9 mg/kg
  Zinc: 644J mg/kg

- One discharging adit was observed at the site which flowed into the waste rock dump. Field parameters were taken with a pH of 8.01.

- Surface water flowed from an unnamed tributary of Snow Creek along the base of the waste rock dump. The chronic aquatic life criteria was exceeded for lead, while the acute aquatic life criteria was exceeded for silver in the upstream sample. No MCLs were exceeded.

- An observed release of silver to the unnamed tributary of Snow Creek (sediment) was documented, which is directly attributable to the site.

- Potential safety hazards observed at the site included two buildings and an open shaft on the ridge above the site.

Lower Black Diamond Jay PA# 07-174
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/27/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
07-174-SE-1	8.9 J	59.5	119	17.3 J	1520	23.2	16.0	142	21900	1180	4400	3330	0.051	18.9	44.2	3510 J	NR
07-174-SE-2	10.9 J	120	65.1	10.1 J	2090	41.1	18.9	167	39600	970	9680	3290	0.052	23.1	8.8	1750 J	NR
07-174-WR-1	6.0 UJ	223	33.0	2.7 J	4630	11.9	2.8	66.2	51400	8590	7030	609	0.47	7.1	12.9	644 J	NR
BACKGROUND	4.7 UJ	9.6	87.6	1.32 JX	NR	27.2 J	9.05 J	10.8 J	21100	52.4 JX	NR	708 J	0.04	10.3	0.5 B	135	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
07-174-WR-1	1.63	50.9	-0.66	-51.6	1.39	0.06	0.18	1.87	-2.54	-2.54	-5.33	40.08	-50.93	-106.95

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
07-174-SW-1	2.7 U	1.8 U	4.8 U	0.35	7230	9.6 U	10.9 U	4.4 U	43.8	1.3 UX	1830	5.2 UJ	0.16 U	13.9 U	0.21 UJX	7.6 U	25.6
07-174-SW-2	2.7 U	1.8 U	12.8	0.23	6720	9.6 U	10.9 U	4.4 U	117	2.4 JX	2030	8.4 J	0.16 U	13.9 U	3.0 JX	32.8	25.1

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
07-174-SW-1	<5.00	< 5	7	NR	NR
07-174-SW-2	10	< 5	14	NR	NR

Legend

SE-1- Downstream of site, 40' below collapsed mill structure.
SE-2- Upstream from site, 50' above WR1.
WR-1- Composite WR1A, WR1B, WR1C.
BACKGROUND- From the Ripple (07-163-SS1) (1994 data).
SW-1- Same as SE-1.
SW-2- Same as SE-2.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Haystack Creek
Legal Description: T 14N R 8E
Mining District: Neihart
Latitude: N 46° 58' 42"
Longitude: W 110° 43' 11"
Land Status: Public
Quad: Neihart
Inspectors: Tuesday, Flammang, Sampson
Organization: Pioneer Technical Services, Inc.

County: Cascade
Section(s): SW 1/4, NW 1/4, Section 16
Mine Type: Hardrock/Ag, Pb, Zn
Primary Drainage: Belt Creek
USGS Code: 10030105
Secondary Drainage: Haystack Creek/Carpenter Creek
Date Investigated: September 23, 1995
P.A. # 07-179

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 5,850 cubic yards. All three waste rock piles were adjacent to Haystack Creek. The following elements were elevated at least three times background:
  Arsenic: 45.4J mg/kg
  Copper: 98.6 to 261 mg/kg
  Mercury: 0.40 to 0.73 mg/kg
  Zinc: 1,010 to 1,250 mg/kg
  Cadmium: 4.7 to 4.9 mg/kg
  Lead: 589JX to 2,800JX mg/kg
  Silver: 3.5 mg/kg

- Two discharging adits were observed at the site. AD-2 (located at the upper portion of the site) discharged along the road. Field parameters were taken for AD-2 with a pH of 5.59. At AD-1, acute and chronic aquatic life criteria were exceeded for aluminum, cadmium, copper, and zinc. Chronic aquatic life criteria were exceeded for iron and lead, and the MCL was exceeded for cadmium. The pH for AD-1 was 3.16.

- Surface water samples taken from Haystack Creek had chronic and acute aquatic life criteria exceedences for copper and zinc. Chronic aquatic life criteria were exceeded for aluminum, cadmium, iron, and lead. No MCLs were exceeded.

- Observed releases in Haystack Creek (sediment) were documented for cadmium, lead, and zinc, and in water for cadmium, lead, zinc, and arsenic.

- Potential safety hazards observed at the site included an open adit at the upper site, two small unstable slopes associated with collapsed AD-1 and AD-2, and steep slopes on WR-2.

Haystack Creek PA# 07-179
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/23/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
07-179-SE-1	6.9 UJ	5.8 UJ	124	10.0	2560	5.4	58.6	168	25100	674 JX	5980 J	2700	0.081	16.2	1.1 U	896	NR
07-179-SE-2	5.9 UJ	5.0 UJ	123	0.85	1440	13.5	17.4	59.5	15900	81.1 JX	3560 J	940	0.042 U	13.1	1.0 U	213	NR
07-179-SE-3	5.7 UJ	9.4 J	142	4.4	2300	10.8	18.7	158	27900	310 JX	4180 J	859	0.050	11.1	0.75 U	870	NR
07-179-SE-4	5.7 UJ	6.5 J	144	2.5	1680	16.5	23.3	115	26700	175 JX	4370 J	1150	0.043 U	18.1	0.78 U	278	NR
07-179-WR-1	5.1 UJ	4.3 UJ	15.6	4.7	654	1.6 U	1.8 U	17.6	3820	1680 JX	935 J	15.3	0.73	2.6	1.3	1010	NR
07-179-WR-2	9.6 J	45.4 J	83.4	4.9	2260	3.7	3.3	98.6	27600	2800 JX	6420 J	148	0.40	7.0	3.5	1250	NR
07-179-WR-3	6.2 UJ	25.9 J	204	1.5	2320	11.3	9.9	261	43900	589 JX	9800 J	423	0.53	6.7	1.4	328	NR
BACKGROUND	4.7 UJ	9.6	87.6	1.32 JX	NR	27.2 J	9.05 J	10.8 J	21100	52.4 JX	NR	708 J	0.04	10.3	0.5 B	135	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
07-179-WR-1	0.12	3.75	-0.07	-3.82	0.07	0.03	0.02	0.94	-1.01	-1.01	-2.12	3.20	-4.09	-8.59
07-179-WR-2	0.34	10.6	3.95	-6.67	0.20	0.06	0.08	1.87	2.08	2.08	4.37	9.06	-6.39	-13.42
07-179-WR-2 DUP	0.35	10.9	4.05	-6.89	0.19	0.07	0.09	2.19	1.86	1.86	3.91	9.45	-6.75	-14.18
07-179-WR-3	0.47	14.7	-0.24	-14.9	0.32	0.06	0.09	1.87	-2.12	-2.12	-4.45	12.19	-15.54	-32.62

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Al (ug/L)	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
07-179-SW-1	94.4 JX	2.7 UJ	1.2 U	10.0	1.6	16500	9.6 U	10.9 U	6.6	313	4.2	2690	129	0.16 U	13.9 U	0.23	329	52.2
07-179-SW-2	78.4 JX	2.7 UJ	1.2 U	10.6	0.21	15200	9.6 U	10.9 U	7.0	319	0.61	2650	77.7	0.16 U	13.9 U	0.26	60.8	48.9
07-179-SW-3	249 JX	2.7 UJ	1.2 U	13.7	0.27	11100	9.6 U	10.9 U	14.0	1650	2.4	2390	126	0.16 U	13.9 U	0.29	77.4	37.5
07-179-SW-4	59.1 JX	2.7 UJ	1.2 U	10.7	0.20	10100	9.6 U	10.9 U	5.9	138	3.6	2210	23.6	0.16 U	13.9 U	0.21 U	49.9	34.2
07-179-AD-1	1710 JX	2.7 UJ	1.2 U	12.3	30.3	48100	9.6 U	29.5	68.9	4070	119	4720	1110	0.16 U	28.1	0.21 U	4980	140

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
07-179-SW-1	124	< 5	43	NR	NR
07-179-SW-2	117	< 5	36	NR	NR
07-179-SW-3	109	< 5	39	NR	NR
07-179-SW-4	216	< 5	29	NR	NR
07-179-AD-1	338	< 5	181	NR	NR

Legend

SE-1- 80 feet downstream of WR-1.
SE-2- 40 feet upstream of WR-2.
SE-3- 30' downstream of WR-3.
SE-4- 20' upstream of open adit above WR-3.
WR-1- Composite WR1A, WR1B.
WR-2- Composite WR2A, WR2B.
WR-3- Composite WR3A, WR3B.
BACKGROUND- From the Ripple (07-163-SS1) (1994 data).
AD-1- Lower collapsed adit at lower site.
SW-1- Same as SE-1.
SW-2- Same as SE-2.
SW-3- Same as SE-3.
SW4- Same as SE-4.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Combination II	County: Granite
Legal Description: T 8N R 14W	Section(s): E 1/2, Section 6; E 1/2, Section 7
Mining District: Combination	Mine Type: Millsite/Au
Latitude: N 46° 28' 00"	Primary Drainage: Flint Creek
Longitude: W 113° 23' 30"	USGS Code: 17010202
Land Status: Public	Secondary Drainage: South Fork Lower Willow Creek
Quad: Black Pine Ridge	
Inspectors: Tuesday, Flammang	Date Investigated: October 19, 1995
Organization: Pioneer Technical Services, Inc.	P.A. # 20-009A

- The site is the downstream extension of the Combination Millsite (P.A. # 20-009) investigated in 1993.

- The volume of tailings associated with the site was approximately 80,250 cubic yards. All of the tailings were located in the drainage of South Fork Lower Willow Creek. The following elements were elevated at least three times background:

Antimony: 229JX to 485JX mg/kg	Arsenic: 652JX to 1,490JX mg/kg
Cadmium: 15.9J to 39.5J mg/kg	Copper: 1,919JX to 5,020JX mg/kg
Lead: 3,910JX to 9,000JX mg/kg	Mercury: 70.5 to 282 mg/kg
Zinc: 220J to 353J mg/kg	

- No waste rock was observed at the site during the investigation.

- There were no discharging adits, filled shafts, seeps, or springs observed at the site during the investigation.

- Surface water from South Fork Lower Willow Creek flowed through the site. Acute and chronic aquatic life criteria were exceeded for copper and zinc. Chronic aquatic life criteria were exceeded for mercury and lead. Acute aquatic life criteria was exceeded for silver, and the MCL for antimony was exceeded.

- Observed releases to South Fork Lower Willow Creek (sediment) were documented for antimony, mercury, and zinc, and observed releases to water were documented for antimony and zinc.

- No potential safety hazards were observed during the investigation.

Combination II Tailings PA# 20-009
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 10/19/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
20-009-SE-1	98.1 JX	266 JX	518 J	16.6 J	2320	13.8 J	19.0	1270 JX	17200 JX	1600 JX	3210	784 JX	46.7	14.5	26.3 JX	522 J	NR
20-009-SE-2	64.5 JX	258 JX	340 J	9.1 J	1520	7.7 J	15.1	1060 JX	13600 JX	1550 JX	1700	1070 JX	24.7	5.4	23.2 JX	268 J	NR
20-009-SE-3	79.3 JX	223 JX	460 J	12.1 J	2150	8.6 J	15.0	1220 JX	15800 JX	1450 JX	2870	707 JX	43.0	18.3	18.8 JX	394 J	NR
20-009-SE-4	26.7 JX	117 JX	361 J	5.6 J	1950	8.8 J	8.7	582 JX	11800 JX	769 JX	2190	639 JX	14.3	8.1	9.7 JX	157 J	NR
20-009-TP2	229 JX	652 JX	320 J	15.9 J	132	2.2 J	3.2	1910 JX	10700 JX	3910 JX	287	357 JX	122	2.3 U	65.0 JX	353 J	0.666
20-009-TP3	447 JX	1230 JX	400 J	36.4 J	123	2.3 UJ	2.6 U	4400 JX	12500 JX	7620 JX	40.5	91.5 JX	70.5	3.3 U	110 JX	220 J	1.49
20-009-TP4	485 JX	1490 JX	716 J	39.5 J	353	2.4 UJ	2.7 U	5020 JX	14700 JX	9000 JX	189	181 JX	282	3.5 U	108 JX	317 J	0.313
BACKGROUND	33.3	76.3	329	2	NR	6.06	6.18	116	11700	85.8	NR	1530 J	1.33 J	6.77	NR	47.4	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
20-009-TP2	0.06	1.87	0.8	-1.07	0.04	0.01	0.01	0.31	0.49	0.49	1.03	1.56	-0.95	-2.00
20-009-TP3	0.16	5	1.07	-3.93	0.15	<0.01	0.01	0	1.07	1.07	2.25	3.83	-3.45	-7.24
20-009-TP4	0.09	2.81	1.05	-1.77	0.08	<0.01	0.01	0	1.05	1.05	2.20	2.19	-1.42	-2.99

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
20-009-SW-1	9.3	2.7	61.5	0.20	3240	8.7 U	8.3 U	23.6 J	84.0 J	2.7	1940	15.7 J	0.48 JX	16.9 U	0.52 JX	26.1	16.1
20-009-SW-2	8.8	2.5	54.4	0.16	3010	8.7 U	8.3 U	25.0 J	172 J	4.0	1820	16.8 J	0.50 JX	16.9 U	0.21 UJX	29.4	15.0
20-009-SW-3	5.8	1.8	53.5	0.16	3100	8.7 U	8.3 U	24.0 J	153 J	3.0	1810	17.9 J	0.46 JX	16.9 U	0.57 JX	22.8	15.2
20-009-SW-4	2.4	1.5 U	63.5	0.068	3370	8.7 U	8.3 U	16.5 J	160 J	1.0	1760	17.9 J	0.22 JX	16.9 U	0.48 JX	9.1 U	15.7

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
20-009-SW-1	46	< 5	10	NR	NR
20-009-SW-2	38	< 5	< 5	NR	NR
20-009-SW-3	40	< 5	11	NR	NR
20-009-SW-4	35	< 5	5	NR	NR

Legend

SE-1- 2 miles downstream of Combination Mill in South Fork Lower Willow Creek at USFS/private boundary.
SE-2- Below Hg-amalgam mill in South Fork Lower Willow Creek; 6000 feet downstream from Combination Mill.
SE-3- Above Hg-amalgam mill in South Fork Lower Willow Creek, 5500 feet downstream from Combination Mill.
SE-4- Just below Combination Mill in South Fork Lower Willow Creek.
TP2- Composite of TP2A,2B, 2C, 2D, 2E, 2F.
TP3- Composite of TP3A, 3B, 3C, 3D.
TP4- TP4B.
BACKGROUND- Taken from Combination Mill (20-009-SS1) (1993 data).
SW-1- Same as SE-1.
SW-2-Same as SE-2.
SW-3- Same as SE-3.
SW-4- Same as SE-4.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Sunrise/Queen Millsite	County: Granite
Legal Description: T 8N R 14W	Section(s): NE 1/4, NE 1/4, Section 3
Mining District: Combination	Mine Type: Millsite/Au
Latitude: N 46° 29' 03"	Primary Drainage: Flint Creek
Longitude: W 113° 20' 05"	USGS Code: 17010202
Land Status: Private	Secondary Drainage: Henderson Creek
Quad: Henderson Mountain	Date Investigated: October 16, 1995
Inspectors: Tuesday, Flammang	P.A. # 20-036
Organization: Pioneer Technical Services, Inc.	

- The volume of tailings associated with the site was approximately 1,550 cubic yards. Most of the tailings have washed out of the impoundment with approximately 95% of the remaining tailings covered with ponded water in Henderson Creek. The following elements were elevated at least three times background:

Arsenic: 866J to 1,230J mg/kg	Copper: 374J to 450J mg/kg
Iron: 42,400 to 50,300 mg/kg	Mercury: 4.3J to 5.9J mg/kg

- The mine site and waste rock dumps were not investigated during the investigation; the dumps were up the hillside and well away from water.

- There were no adit discharges, filled shafts, seeps, or springs investigated during the investigation.

- Surface water from Henderson Creek flowed through the tailings. Chronic aquatic life criteria was exceeded for mercury. No acute aquatic life criteria or MCLs were exceeded.

- Observed releases to Henderson Creek (sediment) was documented for arsenic, copper, and iron; arsenic and iron were observed releases to water.

- Potential safety hazards observed at the site included a collapsing bunkhouse.

Sunrise/ Queen Millsite PA# 20-036
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 10/16/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
20-036-SE-1	6.8 UJX	381 J	193	1.2	3100	4.8 J	6.0 J	77.8 J	28500	9.3 UJ	3550	1710	0.19 J	3.1 UJX	1.0 U	21.7	NR
20-036-SE-2	5.5 UJX	15.2 J	91.5	0.59 U	2160	4.6 J	3.3 J	14.4 J	7280	9.1 J	1090	326	0.067 J	3.0 JX	0.78 U	23.4	NR
20-036-TP1	10.6 JX	1230 J	40.2	2.6	480	1.3 UJ	1.5 UJ	374 J	50300	38.8 J	115	15.4	5.9 J	1.9 UJX	16.5	10.4	0.374
20-036-TP2	6.4 UJX	866 J	69.4	2.8	1060	2.4 J	2.2 UJ	450 J	42400	28.1 J	777	77.7	4.3 J	3.8 JX	9.9	15.9	0.653
BACKGROUND	33.3	76.3	329	2	NR	6.06	6.18	116	11700	85.8	NR	1530 J	1.33 J	6.77	NR	47.4	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
20-036-TP-1	0.29	9.06	-0.94	-10	0.28	0.01	<0.01	0.31	-1.25	-1.25	-2.63	6.88	-9.77	-20.52
20-036-TP-2	0.33	10.3	3.04	-7.27	0.32	<0.01	0.01	0	3.04	3.04	6.38	7.81	-5.97	-12.53

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
20-036-SW-1	4.6	87.9	106	0.046 U	36400	8.7 U	8.3 U	7.3 J	1540 J	0.93	7270	119 J	0.14 UJX	16.9 U	0.37 JX	9.1 U	121
20-036-SW-2	4.6	16.6	113	0.046 U	33900	8.7 U	8.3 U	3.4 J	286 J	0.95	6570	167 J	0.20 JX	16.9 U	0.46 JX	9.1 U	112

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
20-036-SW-1	208	7	22.0	NR	NR
20-036-SW-2	174	< 5	16	NR	NR

Legend

SE-1- Downstream of site in Henderson Creek.
SE-2- Upstream of site in Henderson Creek.
TP1- Composite of TP1A, 1B.
TP2- Composite of TP2A, 2B, 3A, 3B.
BACKGROUND- Taken from the Combination Mill (20-009-SS1) (1993 data).
SW-1- Same as SE-1.
SW-2- Same as SE-2.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Douglas Creek Waste Rock
Legal Description: T 7N R 13W
Mining District: Philipsburg
Latitude: N 46° 18' 50"
Longitude: W 113° 16' 15"
Land Status: Private
Quad: Philipsburg
Inspectors: Tuesday, Flammang, Bisch
Organization: Pioneer Technical Services, Inc.

County: Granite
Section(s): SE 1/4, SW 1/4, Section 31
Mine Type: Hardrock/Au, Ag
Primary Drainage: Flint Creek
USGS Code: 17010202
Secondary Drainage: Douglas Creek
Date Investigated: October 19, 1995
P.A. # 20-503

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 76,000 cubic yards. Waste rock was located adjacent to Douglas Creek and the diverted adit discharge. The following elements were elevated at least three times background:
  Arsenic: 1,450JX mg/kg
  Lead: 116JX mg/kg
  Mercury: 2.5 mg/kg

- One discharging adit was observed at the site which flowed around the waste rock. Acute and chronic aquatic life criteria were exceeded for zinc. Chronic aquatic life criteria was exceeded for iron and mercury. No MCLs were exceeded. The pH was 6.5.

- Surface water from Douglas Creek flowed near the waste rock. Acute and chronic aquatic life criteria were exceeded for zinc. Chronic aquatic life criteria was exceeded for mercury, and the MCL for antimony was exceeded.

- Potential safety hazards observed at the site included an open adit, a collapsing cabin, a loadout, and a highwall above a pit.

Douglas Creek Waste Rock PA# 20-503
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 10/19/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
20-503-SE-1	45.3 JX	1770 JX	169 J	3.5 J	1130	2.1 UJ	4.0	62.8 JX	13300 JX	331 JX	1140	5610 JX	2.3	3.1 U	48.1 JX	661 J	NR
20-503-SE-2	28.1 JX	1910 JX	160 J	3.3 J	1260	2.1 J	4.9	65.4 JX	11200 JX	313 JX	1690	5800 JX	4.1	2.9 U	71.5 JX	672 J	NR
20-503-WR-1	5.9 JX	1450 JX	152 J	1.2 J	1700	1.8 UJ	2.9	18.4 JX	16900 JX	116 JX	1150	258 JX	2.5	2.7 U	27.2 JX	57.8 J	NR
BACKGROUND	4 UJ	25 J	286	0.5 U	NR	4.6	9.8	9	13900	9	NR	1230	0.161 JX	11	NR	41	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
20-503-WR-1	0.37	11.6	2.16	-9.4	0.3	<0.01	0.07	0	2.16	2.16	4.54	9.22	-8.82	-18.53
20-503-WR-1 (dup)	0.37	11.6	1.96	-9.6	0.29	0.02	0.06	0.62	1.34	1.34	2.81	9.30	-9.17	-19.26

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
20-503-SW-1	6.9	101	19.0	1.6	61000	8.7 U	8.3 U	5.8 J	886 J	1.5	11700	9180 J	0.14 UJX	16.9 U	1.9 JX	1550	200
20-503-SW-2	8.1	128	22.7	0.25	15500	8.7 U	8.3 U	4.7 J	294 J	1.4	3320	1700 J	0.17 JX	16.9 U	0.21 UJX	417	52.3
20-503-AD-1	4.6	188	12.4	3.5	131000	8.7 U	9.1	12.1 J	3830 J	1.5	24200	21700 J	0.22 JX	16.9 U	4.2 JX	3330	426

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
20-503-SW-1	326	< 5	190	NR	NR
20-503-SW-2	102	< 5	43.0	NR	NR
20-503-AD-1	691	< 5	451	NR	NR

Legend

SE-1- Downstream of site in Douglas Creek.
SE-2- Upstream of site in Douglas Creek.
WR-1- Composite of WR1A, 1B, 1C, 1D.
BACKGROUND- Taken from Granite Mtn Mine (20-110-SS1) (1993 data).
AD-1- Adit discharge above WR1.
SW-1- Same as SE-1.
SW-2- Same as SE-2.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Port Royal Mill Tailings
Legal Description: T 8N R 12W
Mining District: Princeton
Latitude: N 46° 22' 00"
Longitude: W 113° 07' 00"
Land Status: Public
Quad: Maxville/Pikes Peak
Inspectors: Tuesday, Flammang, Bisch
Organization: Pioneer Technical Services, Inc.

County: Granite
Section(s): NE 1/4, Section 32; NW 1/4, NW 1/4, Section 33
Mine Type: Tailings/Au
Primary Drainage: Flint Creek
USGS Code: 17010202
Secondary Drainage: Royal Gold Creek/Boulder Creek
Date Investigated: October 17, 1995
P.A. # 20-016

- The volume of mill tailings observed at the site was approximately 3,875 cubic yards. The tailings were mostly revegetated. The following elements were elevated at least three times background:
  Antimony: 16.8JX mg/kg
  Arsenic: 54J to 63.6J mg/kg
  Cadmium: 3.8 mg/kg
  Copper: 429J to 924J
  Lead: 1,290J to 2,050J
  Mercury: 1.3J to 11.6J mg/kg
  Zinc: 786 to 1,480 mg/kg

- No waste rock dumps were observed at the site during the investigation.

- No discharging adits, filled shafts, seeps, or springs were observed at the site during the investigation.

- Royal Gold Creek flowed through the tailings. The acute and chronic aquatic life criteria were exceeded for copper. The chronic aquatic life criteria was exceeded for mercury and lead, while the acute aquatic life criteria was exceeded for silver. No MCLs were exceeded.

- An observed release in Royal Gold Creek (sediment) of arsenic, cadmium, copper, mercury, and zinc was attributable to the site.

- No potential safety hazards were observed at the site during the investigation.

Port Royal Mill Tailings PA# 20-016
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 10/17/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
20-016-SE-1	8.8 JX	6.9 UJ	49.3	1.9	1100	2.5 UJ	2.9 UJ	51.2 J	8400	369 J	1530	841	0.17 J	3.7 UJX	1.2 U	275	NR
20-016-SE-2	7.4 JX	8.8 JX	45.5 J	2.0 J	938	2.2 UJ	2.5 U	32.8 JX	4210 JX	143 JX	812	1300 JX	0.084	3.1 U	1.9 JX	652 J	NR
20-016-SE-3	15.2 UJX	31.8 JX	84.5 J	5.8 J	5330	4.7 UJ	6.9	206 JX	13400 JX	817 JX	2170	910 JX	1.6	6.8 U	7.5 JX	1000 J	NR
20-016-TP1	16.8 JX	63.6 J	78.2	3.8	905	2.6 UJ	3.0 UJ	924 J	11800	2050 J	580	255	11.6 J	3.8 UJX	17.8	1480	1.08
20-016-TP2	12.7 JX	54.0 J	80.4	2.4	701	1.8 UJ	2.0 UJ	429 J	9610	1290 J	644	1070	1.3 J	2.6 UJX	4.1	786	<0.282
BACKGROUND	5 U	17 JX	122	0.8 J	NR	34.2 J	10.4 J	34.6	23500 J	38 J	NR	1040 J	0.06 J	36 J	NR	106 J	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
20-016-TP1	0.02	0.62	2.63	2.01	0.02	<0.01	<0.01	0	2.63	2.63	5.52	0.47	2.70	5.67
20-016-TP2	0.01	0.31	3.14	2.82	0.01	<0.01	<0.01	0	3.14	3.14	6.59	0.23	3.63	7.63

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
20-016-SW-1	1.9	1.5 U	3.2	0.046 U	7250	8.7 U	8.3 U	5.0 J	34.4 J	1.4	585	4.5 J	0.17 JX	16.9 U	0.34 JX	16.0	20.5
20-016-SW-2	1.9 U	1.5 U	4.5	0.046 U	7270	8.7 U	8.3 U	6.5 J	176 J	2.9	584	32.5 J	0.22 JX	16.9 U	0.25 JX	12.6	20.6
20-016-SW-3	1.9 U	1.5 U	4.2	0.046 U	7860	8.7 U	8.3 U	5.9 J	130 J	2.3	638	7.9 J	0.20 JX	16.9 U	0.53 JX	15.9	22.3

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
20-016-SW-1	28	< 5	5	NR	NR
20-016-SW-2	32	< 5	6	NR	NR
20-016-SW-3	41	< 5	6	NR	NR

Legend

SE-1- Upstream of tailings in Royal Gold Creek.
SE-2- Just below tailings/wetlands deposit in Royal Gold Creek.
SE-3- Above Nonpareil in Royal Gold Creek.
TP1- Composite TP1A, TP1C (floodplain).
TP2- Composite TP1B and TP1D (reprocess area).
BACKGROUND- Taken from Jackson Park Mine (20-027-SS1) (1993 data).
SW-1- Same as SE-1.
SW-2- Same as SE-2.
SW-3- Same as SE-3.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Bullion Smelter	County: Jefferson
Legal Description: T 7N R 6W	Section(s): NE 1/4, SW 1/4, Section 14
Mining District: Basin	Mine Type: Smelter/Au, Ag, Cu, Pb, Zn
Latitude: N 46° 21' 22"	Primary Drainage: Basin Creek
Longitude: W 112° 17' 40"	USGS Code: 10020006
Land Status: Public	Secondary Drainage: Jack Creek
Quad: Basin	Date Investigated: September 14, 1995
Inspectors: Tuesday, Flammang, Clark, Liebelt	P.A. # 22-505
Organization: Pioneer Technical Services, Inc.	

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 1,425 cubic yards. The following elements were elevated at least three times background:

Arsenic: 371 mg/kg	Lead: 286J mg/kg

- The volume of slag material associated with the site was approximately 737 cubic yards. The following elements were elevated at least three times background:

Antimony: 17.4J mg/kg	Cadmium: 6.6 mg/kg
Copper: 1,940J mg/kg	Iron: 199,000 mg/kg
Lead: 767J mg/kg	Zinc: 9,510J mg/kg

- There were no discharging adits, filled shafts, seeps, or springs observed at the site during the investigation.

- Surface water from an unnamed tributary of Jack Creek flowed approximately 20 feet south of the site. The acute aquatic life criteria for silver was exceeded. No other aquatic life criteria or MCLs were exceeded.

- Potential safety hazards observed at the site included an ore bin above the site to the north and a highwall behind the ore bin.

Bullion Smelter PA# 22-505
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/14/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-505-SE-1	5.6 UJ	5.4	75.4	0.59 U	1690	5.8	6.5	19.4 J	11800	20.8 J	1880	383	0.054	3.3	1.33	85.7 J	NR
22-505-SE-2	5.8 UJ	6.1	106	0.96	1480	7.1	16.0	15.8 J	15000	14.9 J	3090	735	0.048 U	6.9	0.96 U	44.2 J	NR
22-505-SL-1	17.4 J	45.9	299	6.6	97500	14.6	63.6	1940 J	199000	767 J	3900	6390	0.036	2.3 U	30.4	9510 J	NR
22-505-WR-1	7.5 J	371	184	0.58 U	611	16.3	9.9	77.7 J	26000	286 J	5080	348	0.040	10.2	2.4	72.0 J	NR
BACKGROUND	5 U	68 J	344	0.6 U	NR	20.3	22.1	35	35000	39 J	NR	6830	0.08 J	21	NR	188	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
22-505-SL1	0.82	25.6	38.5	12.9	0.38	0.02	0.42	0.62	37.90	37.90	79.59	22.66	19.80	41.59
22-505-WR-1	0.03	0.94	1.29	0.35	0.02	<0.01	0.01	0.00	1.29	1.29	2.71	0.78	0.64	1.34

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Al (ug/L)	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
22-505-SW-1	50.3 JX	2.7 UJ	1.2 U	35.4	0.064 U	6710	9.6 U	10.9 U	4.4 U	90.7	0.58 U	1430	5.2 U	0.16 U	13.9 U	0.56	7.6 U	22.6
22-505-SW-2	54.7 JX	2.7 UJ	1.2 U	35.9	0.064 U	6530	9.6 U	10.9 U	4.4 U	77.3	0.58 U	1430	5.2 U	0.16 U	13.9 U	0.21 U	7.6 U	22.2

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
22-505-SW-1	194	< 5	< 5	NR	NR
22-505-SW-2	50	< 5	6	NR	NR

Legend

SE-1- Downstream of site in tributary.
SE-2- Upstream of site in tributary.
SL1- Slag pile in west-center of site.
WR-1- Subsample of WR18.
BACKGROUND- From the Bullion Mine (22-008-SS1) (1993 data).
SW-1- Same as SE-1.
SW-2- Same as SE-2.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Frohner
Legal Description: T 8N R 5W
Mining District: Clancy
Latitude: N 46° 26' 28"
Longitude: W 112° 12' 48"
Land Status: Private
Quad: Chessman Reservoir
Inspectors: Tuesday, Flammang, Clark, Liebelt
Organization: Pioneer Technical Services, Inc.

County: Jefferson
Section(s): NW 1/4, SE 1/4, Section 15
Mine Type: Hardrock/Au, Ag, Cu, Pb, Zn
Primary Drainage: Lump Gulch
USGS Code: 10030101
Secondary Drainage: Lump Gulch
Date Investigated: September 15, 1995
P.A. # 22-243

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 11,730 cubic yards. Adit discharges flowed over and through WR-6 and WR-7 The following elements were elevated at least three times background:

  Antimony: 16.3J mg/kg
  Arsenic: 372J to 6,050 mg/kg
  Copper: 48.2J mg/kg
  Lead: 261J to 4,250J mg/kg
  Mercury: 0.62 to 0.97 mg/kg

- Two discharging adits were observed at the site which flowed over and through the waste rock. At AD-1, the acute and chronic aquatic life criteria were exceeded for cadmium, copper, lead, and zinc; pH was 7.49. Chronic aquatic life criteria was exceeded for aluminum and iron. The MCL was exceeded for cadmium. At AD-2, the acute and chronic aquatic life criteria were exceeded for aluminum, arsenic, copper, lead, and zinc; pH was 3.90. The chronic aquatic life criteria was exceeded for iron, and the MCL was exceeded for cadmium.

- Surface water flowed from an unnamed tributary of Lump Gulch along the base of WR-7. Acute and chronic aquatic life criteria were exceeded for aluminum, cadmium, copper, and zinc. Chronic aquatic life criteria was exceeded for iron and lead, and the MCL was exceeded for cadmium.

- An observed release to the unnamed tributary of Lump Gulch was documented for arsenic and lead in water and sediments, and copper in water.

- Potential safety hazards observed at the site included a cabin and a fenced open stope; two open shafts exist, but have been grated.

Frohner Mine PA# 22-243
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/15/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-243-SE-1	5.9 UJ	375 J	62.3	1.8	789	3.0	5.6	16.5	10400	298 J	1160 J	1200	0.065	5.8	1.0 U	192	NR
22-243-SE-2	7.0 UJ	8.0 J	312	0.88	1030	4.2	6.2	6.4	7500	16.6 J	1010 J	3120	0.048	3.2 U	0.71 U	28.3	NR
22-243-WR-1	16.3 J	6050	52.4	0.56 U	17.6	1.6 U	1.9 U	48.2 J	10700	4250 J	19.1	3.3	0.97	2.4 U	26.6	50.3 J	NR
22-243-WR-2	5.5 UJ	372 J	26.9	0.59 U	36.9	1.7 U	1.9 U	10.9	3660	1410 J	31.7 J	6.8	0.62	3.2	2.8	88.8	NR
22-243-WR-3	5.4 UJ	802	76.4	0.57 U	66.9	1.7 U	1.9 U	9.8 J	8020	261 J	19.7	16.9	0.62	2.4 U	1.1	59.0 J	NR
BACKGROUND	3.4 UJ	10	52.7	1.3	NR	2.23 J	3.15	6.12	6390	21.9	NR	284	0.035 J	2.6	NR	43.6	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
22-243-WR-1	0.26	8.12	-1.71	-9.38	0.23	0.01	0.02	0.31	-2.02	-2.02	-4.24	6.33	-10.05	-21.10
22-243-WR-2	0.08	2.50	-0.86	-3.36	0.07	0.01	<0.01	0.31	-1.17	-1.17	-2.46	1.95	-3.52	-7.38
22-243-WR-3	0.12	3.75	-3.90	-7.65	0.11	0.01	<0.01	0.31	-4.21	-4.21	-8.84	2.89	-8.49	-17.83

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Al (ug/L)	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
22-243-SW-1	853 J	2.7 UJ	35.6	19.4	7.3	12700	9.6 U	10.9 U	13.5	1730	15.4	2020	2460	0.16 U	13.9 U	0.80	40.1	1420
22-243-SW-2	37.1 UJ	2.7 UJ	1.2 U	16.6	0.064 U	8780	9.6 U	10.9 U	4.4 U	40.4	0.58 U	1180	5.2 U	0.16 U	13.9 U	0.23	26.8	7.6 U
22-243-AD-1	199 J	2.7 UJ	120	55.5	6.9	12800	9.6 U	10.9 U	22.1	1920	112	1240	610	0.16 U	13.9 U	0.31	37.0	1060
22-243-AD-2	1350 J	2.7 UJ	1440	17.0	36.1	24900	9.6 U	33.0	20.8	33200	459	4550	10000	0.16 U	25.1	1.8	80.9	5590

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
22-243-SW-1	119	< 5	60	NR	NR
22-243-SW-2	51	< 5	7	NR	NR
22-243-AD-1	106	< 5	41	NR	NR
22-243-AD-2	297	< 5	178	NR	NR

Legend

SE-1- 40 feet downstream of WR7 in Lump Gulch.
SE-2- Upstream of WR7 in Lump Gulch.
AD-1- Discharging adit associated with WR6.
AD-2- Discharging adit associated with WR7.
SW-1- Same as SE-1.
SW-2- Same as SE-2.
WR-1- Composite WR1, WR2, WR3, and WR4.
WR-2- Composite WR5 and WR6.
WR-3- Composite WR7A and WR7B.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Carter	County: Judith Basin
Legal Description: T 15N R 9E	Section(s): SW 1/4, NW 1/4, Section 6
Mining District: Hughesville	Mine Type: Hardrock/Ag, Pb
Latitude: N 47° 05' 25"	Primary Drainage: Dry Fork Belt Creek
Longitude: W 110° 38' 36"	USGS Code: 10030105
Land Status: Private	Secondary Drainage: Green Creek/Galena Creek
Quad: Barker	
Inspectors: Tuesday, Flammang, Liebelt	Date Investigated: September 26, 1995
Organization: Pioneer Technical Services, Inc.	P.A. # 23-019

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 3,500 cubic yards. Water from the adit discharge flowed over and on the east side of the lower waste rock dump. The following elements were elevated at least three times background:

Arsenic: 205 to 214 mg/kg	Cadmium: 6.7J mg/kg
Copper: 135JX to 564JX mg/kg	Iron: 121,000 mg/kg
Lead: 1,840 to 2,050 mg/kg	Manganese: 2,270 mg/kg
Mercury: 0.15 to 0.32 mg/kg	

- One discharging adit was observed at the site which flowed over and along the waste rock. The chronic aquatic life criteria was exceeded for iron. No acute aquatic life criteria or MCLs were exceeded. The pH was 7.3.

- Green Creek flowed 75 to 100 feet from the waste rock dump. The chronic aquatic life criteria was exceeded for lead. No acute aquatic life criteria or MCLs were exceeded.

- An observed release to Green Creek was documented for copper (sediment) and iron (water).

- Potential safety hazards associated with the site included an adit opening, a highwall associated with the adit, and unstable waste rock piles.

Carter Mine PA# 23-019
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE:

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
23-019-SE-1	6.0 UJ	38.7	67.7 J	2.9 J	6890	1.9 U	3.9	163 JX	22700	70.1	3980	638	0.049 U	4.0	0.9 U	442	NR
23-019-SE-2	10.2 UJ	34.7	102 J	3.0 J	32400	4.9	7.3	48.8 JX	20400	97.2	15900	513	0.069 U	11.3	1.5 U	696	NR
23-019-WR-1	5.4 UJ	214	97.4 J	1.5 J	51900	1.7 U	5.7	135 JX	30000	1840	31100	2270	0.32	9.7	22.9	287	NR
23-019-WR-2	6.8 UJ	205	46.6 J	6.7 J	23800	2.1 U	2.4 U	564 JX	121000	2050	6180	180	0.15	3.1 U	12.0	228	NR
BACKGROUND	3.98 UJ	5.1 J	159 J	1 U	NR	8.09 J	3.83	9.81 J	13300	61.4	NR	548	0.02772	7.93	NR	130	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potant. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
23-019-WR-1	0.72	22.5	184	162	0.15	0.24	0.33	7.50	177.00	177.00	371.70	21.33	203.34	427.01
23-019-WR-2	3.21	100	20.9	-79.3	1.07	0.37	1.77	11.6	-9.38	-9.38	-19.70	91.96	-88.82	-186.52

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
23-019-SW-1	2.7 U	6.9	27.8	0.16	45600	9.6 U	10.9 U	4.4 U	518	2.9 JX	18200	113 J	0.16 U	13.9 U	0.21 UJX	93.8	189
23-019-SW-2	2.7 U	2.5	38.6	0.064 UJ	52800	9.6 U	10.9 U	4.4 UJ	136	1.4 J	14800	40.5	0.16 U	13.9 U	0.21 U	11.0 J	193
23-019-AD-1	2.7 U	14.9	8.6	0.064 UJ	39700	9.6 U	10.9 U	8.3 J	1410	1.2 J	20800	205	0.16 U	13.9 U	1.1	86.8 J	185

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
23-019-SW-1	198	< 5	46	NR	NR
23-019-SW-2	184.0	< 5	27.0	NR	NR
23-019-AD-1	168.0	< 5	42	NR	NR

Legend

SE-1- 8' downstream of adit discharge confluence with Green Creek.
SE-2- 260' upstream of WR1 north side.
WR-1- Composite of WR1A, WR1B, WR1C.
WR-2- Composite of WR2A, WR2B, WR2C.
BACKGROUND- From the Tiger Mine (23-059-SS1) (1993 data).
AD-1- Taken at adit portal.
SW-1- Same as SE-1.
SW-2- Same as SE-2.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: M.T.A.
Legal Description: T 15N R 9E
Mining District: Hughesville
Latitude: N 47° 04' 55"
Longitude: W 110° 37' 47"
Land Status: Private
Quad: Barker
Inspectors: Tuesday, Flammang, Liebelt
Organization: Pioneer Technical Services, Inc.

County: Judith Basin
Section(s): NW 1/4, NE 1/4, Section 7
Mine Type: Hardrock/Ag-Pb
Primary Drainage: Dry Fork Belt Creek
USGS Code: 10030105
Secondary Drainage: Galena Creek
Date Investigated: September 26, 1995
P.A. # 23-040

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 5,260 cubic yards. Waste rock was situated in a steep, dry drainage that discharges to Galena Creek. The following elements were elevated at least three times background:
  Antimony: 14.8J mg/kg
  Arsenic: 744 mg/kg
  Barium: 159J mg/kg
  Cadmium: 9.5J mg/kg
  Copper: 66.7JX mg/kg
  Lead: 11,900 mg/kg
  Mercury: 3 mg/kg
  Zinc: 1,640 mg/kg

- There were no discharging adits, filled shafts, seeps, or springs observed at the site during the investigation, though one adit probably discharges at wetter times of the year.

- No surface water flowed on or near the site during the investigation. The nearest surface water was over 1,000 feet away; no surface water samples were collected.

- Potential safety hazards observed at the site included two open adits and a loadout.

M.T.A. PA# 23-040
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/26/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
23-040-WR-1	14.8 J	744	641 J	9.5 J	299	1.7 U	2.0 U	66.7 JX	32100	11900	441	79.0	3.0	2.5 U	40.6	1640	NR
BACKGROUND	3.98 UJ	5.1 J	159 J	1 U	NR	8.09 J	3.83	9.81 J	13300	61.4	NR	548	0.02772	7.93	NR	130	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
23-040-WR-1	1.22	38.1	-4.70	-42.8	1.04	0.06	0.12	1.87	-6.58	-6.58	-13.82	30.00	-43.38	-91.09

Legend

WR-1- WR1A, 2A, 2B, 3A, 3B.
BACKGROUND- From the Tiger Mine (23-059-SS1) (1993 data).

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Belfont
Legal Description: T 15N R 9E
Mining District: Hughesville
Latitude: N 47° 05' 18"
Longitude: W 110° 37' 32"
Land Status: Private
Quad: Barker
Inspectors: Tuesday, Flammang, Liebelt
Organization: Pioneer Technical Services, Inc.

County: Judith Basin
Section(s): NE 1/4, SE 1/4, Section 6
Mine Type: Hardrock/Ag, Pb
Primary Drainage: Dry Fork Belt Creek
USGS Code: 10030105
Secondary Drainage: Daisy Creek/Galena Creek
Date Investigated: September 26, 1995
P.A. # 23-060

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 2,325 cubic yards. The following elements were elevated at least three times background:
  Arsenic: 1,030 mg/kg
  Barium: 529 mg/kg
  Cadmium: 5.7J mg/kg
  Copper: 45.4 mg/kg
  Iron: 44,600 mg/kg
  Lead: 2,850 mg/kg
  Mercury: 1.2 mg/kg
  Zinc: 872J mg/kg

- There were no discharging adits, filled shafts, seeps, or springs observed at the site during the investigation, though at wetter times of the year, the adit shows evidence of discharging.

- Surface water flow from Daisy Creek was adjacent to the waste rock. Chronic and acute aquatic life criteria were exceeded for copper and zinc. Chronic aquatic life criteria were exceeded for cadmium and lead. No MCLs were exceeded.

- Potential safety hazards observed at the site included an open adit, two cabins, and a highwall.

BELFONT MINE PA# 23-060
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/26/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
23-060-SE-1	7.1 UJ	39.9	265	10.0 J	2130	5.9	5.3	482	47200	1410	1090	5630	0.15	5.0	4.9	1540 J	NR
23-060-SE-2	7.2 UJ	152	818	25.1 J	16100	5.6	2.5 U	1820	98000	9120	9940	17300	0.28	3.2 U	38.4	4960 J	NR
23-060-WR-1	7.8 J	1030	529	5.7 J	37.0	6.0	2.0 U	45.4	44600	2850	483	151	1.2	2.6 U	49.7	872 J	NR
BACKGROUND	3.98 UJ	5.1 J	159 J	1 U	NR	8.09 J	3.83	9.81 J	13300	61.4	NR	548	0.02772	7.93	NR	130	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
23-060-WR-1	1.44	45.0	-9.78	-54.8	0.77	0.14	0.53	4.37	-14.20	-14.20	-29.82	38.99	-60.96	-128.01

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
23-060-SW-1	2.7 U	1.9	27.0	3.3	55900	9.6 U	10.9 U	142	357	32.3 JX	18100	844 J	0.16 U	13.9 U	0.66 JX	918	214
23-060-SW-2	2.7 U	1.8 U	24.8	4.3	60800	9.6 U	10.9 U	197	481	41.2 JX	19700	1060 J	0.16 U	13.9 U	2.7 JX	1020	233

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
23-060-SW-1	306	< 5	170	NR	NR
23-060-SW-2	305	< 5	188	NR	NR

Legend

SE-1- Downstream of site in Daisy Creek.
SE-2- Upstream of site in Daisy Creek
WR-1- Composite of WR1A, WR1B, WR2A, & WR2B.
BACKGROUND- From the Tiger Mine (23-059-SS1) (1993 data).
SW-1- Same as SE1.
SW-2- Same as SE2.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Sinclair
Legal Description: T 15N R 9E
Mining District: Hughesville
Latitude: N 47° 04' 55"
Longitude: W 110° 38' 07"
Land Status: Private
Quad: Barker
Inspectors: Tuesday, Flammang, Liebelt
Organization: Pioneer Technical Services, Inc.

County: Judith Basin
Section(s): NE 1/4, NW 1/4, Section 7
Mine Type: Hardrock/Ag, Pb
Primary Drainage: Dry Fork Belt Creek
USGS Code: 10030105
Secondary Drainage: Galena Creek
Date Investigated: September 27, 1995
P.A. # 23-501

- No mill tailings were observed at the site during the investigation.
- The volume of waste rock associated with the site was approximately 1,679 cubic yards. The waste rock was adjacent to an unnamed tributary of Galena Creek. The following elements were elevated at least three times background:

Arsenic: 203 mg/kg	Copper: 33 mg/kg
Lead: 5,000 mg/kg	Mercury: 1.1 mg/kg

- There were no discharging adits, filled shafts, seeps, or springs observed at the site during the investigation.
- Surface water flowed from an unnamed tributary of Galena Creek along the base of the waste rock. Acute and chronic aquatic life criteria were exceeded for cadmium, copper, lead, and zinc. Chronic aquatic life criteria was exceeded for iron, and the MCL was exceeded for cadmium.
- An observed release to the unnamed tributary of Galena Creek (sediment) was documented for arsenic, copper, mercury, and (water) lead.
- Potential safety hazards observed at the site included a gated adit and a cabin.

Sinclair Mine PA# 23-501
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/27/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
23-501-SE-1	15.4 J	664	313	6.5 J	1610	5.7	3.1 U	236	40700	9960	810	289	1.7	3.9 U	115	1100 J	NR
23-501-SE-2	10.3 J	157	77.0	1.2 J	695	2.6	2.3 U	53.4	9910	6380	386	96.3	0.18	2.9 U	28.3	204 J	NR
23-501-WR-1	7.2 J	203	191	1.3 J	69.8	1.5 U	1.7 U	33.0	16000	5000	78.7	35.7	1.1	2.2 U	28.8	200 J	NR
BACKGROUND	3.98 UJ	5.1 J	159 J	1 U	NR	8.09 J	3.83	9.81 J	13300	61.4	NR	548	0.02772	7.93	NR	130	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potant. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
23-501-WR1	0.57	17.8	-3.14	-20.9	0.51	0.03	0.03	0.94	-4.08	-4.08	-8.57	13.83	-21.21	-44.54

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
23-501-SW-1	2.7 U	3.8	21.3	17.2	26300	9.6 U	10.9 U	48.2	2000	121 JX	3090	1700 J	0.16 U	13.9 U	0.70 JX	2780	78.4
23-501-SW-2	2.7 U	4.9	23.3	12.2	26100	9.6 U	10.9 U	51.3	2190	24.1 JX	2710	1260 J	0.16 U	13.9 U	0.21 UJ	2560	76.4

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
23-501-SW-1	127	< 5	82	NR	NR
23-501-SW-2	129	< 5	57	NR	NR

Legend

SE-1- 100 feet below WR1 in tributary of Galena Creek.
SE-2- 50 feet above site in tributary of Galena Creek.
WR-1- Composite of WR1A & WR1B.
BACKGROUND- From the Tiger Mine (23-059-SS1) (1993 data).
SW-1- Same as SE-1.
SW-2- Same as SE-2.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: May and Edna
Legal Description: T 15N R 9E
Mining District: Hughesville
Latitude: N 47° 05' 25"
Longitude: W 110° 38' 36"
Land Status: Private
Quad: Barker
Inspectors: Tuesday, Flammang, Liebelt
Organization: Pioneer Technical Services, Inc.

County: Judith Basin
Section(s): SW 1/4, NW 1/4, Section 6
Mine Type: Hardrock/Ag, Pb
Primary Drainage: Dry Fork Belt Creek
USGS Code: 10030105
Secondary Drainage: Green Creek/Galena Creek
Date Investigated: September 26, 1995
P.A. # 23-502

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 2,000 cubic yards. The waste rock was located adjacent to Green Creek and was in contact with surface water when flowing. The following elements were elevated at least three times background:

  Arsenic: 71.6 mg/kg
  Copper: 1,120JX mg/kg
  Lead: 1,740 mg/kg
  Zinc: 491 mg/kg
  Cadmium: 9.6J mg/kg
  Iron: 135,000 mg/kg
  Mercury: 0.41 mg/kg

- There were no discharging adits, shafts, or seeps at the site during the investigation; however, a spring was observed 20 feet south of the waste rock. No samples were collected.

- No other surface water flowed on or near the site except for the spring during the investigation. The next closest surface water source was over 1,000 feet away; no surface water samples were collected.

- Observed releases to Green Creek (sediment) were documented for cadmium, copper, and zinc.

- No potential safety hazards were observed during the investigation.

May & Edna PA# 23-502
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/26/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
23-502-SE-1	4.4 UJ	24.0	70.2 J	1.0 J	91600	5.1	3.2	4.38 JX	14000	320	35400	677	0.040 U	7.4	0.6 U	156	NR
23-502-SE-2	6.4 UJ	30.4	276 J	7.0 J	27100	3.8	15.4	87.0 JX	20700	383	14800	2950	0.056 U	13.5	4.3	1360	NR
23-502-WR-1	5.0 UJ	71.6	45.1 J	9.6 J	8700	6.5	1.8 U	1120 JX	135000	1740	983	229	0.41	11.6	54.8	491	NR
BACKGROUND	3.98 UJ	5.1 J	159 J	1 U	NR	8.09 J	3.83	9.81 J	13300	61.4	NR	548	0.02772	7.93	NR	130	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
23-502-WR-1	9.27	290	21.2	-268	<0.01	1.07	10.0	33.6	-12.30	-12.30	-25.83	345.94	-405.92	-852.44

Legend

SE-1- 40 feet upstream of site in Green Creek.
SE-2- 25 feet downstream from site in Green Creek.
WR 1- Composite WR1A, 1B, 1C, 1D.
BACKGROUND- From the Tiger Mine (23-059-SS1) (1993 data).

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Kelley
Legal Description: T 3N R 12E
Mining District: Big Timber Canyon
Latitude: N 46° 02' 07"
Longitude: W 110° 17' 25"
Land Status: Public
Quad: Crazy Peak
Inspectors: Tuesday, Flammang
Organization: Pioneer Technical Services, Inc.

County: Park
Section(s): SW 1/4, NW 1/4, Section 6
Mine Type: Hardrock/Ag-Pb
Primary Drainage: Big Timber Creek
USGS Code: 10070002
Secondary Drainage: Blue Lake
Date Investigated: October 6, 1995
P.A. # 34-113

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 725 cubic yards. The following elements were elevated at least three times background:
  Antimony: 25.2JX mg/kg
  Arsenic: 145J mg/kg
  Barium: 433 mg/kg
  Cadmium: 5.2 mg/kg
  Copper: 856J mg/kg
  Lead: 2,640J mg/kg
  Manganese: 4,660 mg/kg
  Mercury: 0.44J mg/kg

- There were no discharging adits, filled shafts, seeps, or springs observed at the site during the investigation, though water was ponded in adit and probably flows at wetter times of the year.

- No surface water flowed on or near the site during the investigation. The nearest surface water was a small lake approximately 100 feet away; no surface water samples were collected.

- The potential safety hazard observed at the site consisted of a partially open adit.

Kelly Mine PA# 34-113
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 10/6/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
34-113-WR-1	25.2 JX	145 J	433	5.2	15300	14.9 J	24.9 J	856 J	52900	2640 J	6980	4660	0.44 J	19.9 JX	22.3	193	NR
BACKGROUND	7.97 UJ	16.3	78.3 J	0.68 J	NR	45.6	13.5	40.1 J	28500	37.2	NR	612	0.06378	24	NR	99	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
34-113-WR-1	0.01	0.31	40.7	40.4	<0.01	0.01	<0.01	0.31	40.40	40.40	84.84	0.31	50.48	106.02

Legend

WR-1- Composite WR1A, WR1B, WR1C.
BACKGROUND- Taken from Poor Man/ Emma (49-001-SS1) (1993 data).

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Stemwinder (South)
Legal Description: T 3N R 11E
Mining District: Big Timber Canyon
Latitude: N 46° 01' 50"
Longitude: W 110° 17' 32"
Land Status: Public
Quad: Crazy Peak
Inspectors: Tuesday, Flammang
Organization: Pioneer Technical Services, Inc.

County: Park
Section(s): SE 1/4, SE 1/4, Section 1
Mine Type: Hardrock/Ag-Pb
Primary Drainage: Big Timber Creek
USGS Code: 10070002
Secondary Drainage: Blue Lake
Date Investigated: October 6, 1995
P.A. # 34-500

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 225 cubic yards. The waste rock was located adjacent to an unnamed tributary of Big Timber Creek and adit discharge flowed over and into it. The following elements were elevated at least three times background:
  Arsenic: 55.7J mg/kg
  Barium: 289 mg/kg
  Cadmium: 3.6 mg/kg
  Copper: 610J mg/kg
  Lead: 6,480J mg/kg
  Manganese: 1,940 mg/kg
  Mercury: 0.54J mg/kg

- One discharging adit was observed at the site which flowed over and through the waste rock. Chronic aquatic life criteria was exceeded for lead and mercury, while acute aquatic life criteria was exceeded for silver. No MCLs were exceeded, and the pH was 8.54.

- Surface water flowed from an unnamed tributary of Big Timber Creek near the waste rock. The chronic aquatic life criteria was exceeded for lead, copper, and mercury, while the acute aquatic life criteria was exceeded for silver. No MCLs were exceeded.

- An observed release to an unnamed tributary of Granite Lake (sediment) was documented for arsenic, copper, and lead.

- The potential safety hazard consisted of an open adit.

Stemwinder Mine PA# 34-500
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 10/6/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
34-500-SE-1	6.6 UJX	22.5 J	276	1.9	5350	21.3 J	17.4 J	80.9 J	21300	755 J	7880	647	0.037 UJ	29.1 JX	0.93 U	61.5	NR
34-500-SE-2	7.5 UJX	6.6 J	140	1.4	3070	24.9 J	12.8 J	13.8 J	14400	21.2 J	6150	312	0.037 UJ	28.7 JX	1.1 U	40.9	NR
34-500-WR-1	5.4 UJX	55.7 J	289	3.6	8380	21.6 J	22.7 J	610 J	34200	6480 J	7750	1940	0.54 J	22.0 JX	17.7	143	NR
BACKGROUND	7.97 UJ	16.3	78.3 J	0.68 J	NR	45.6	13.5	40.1 J	28500	37.2	NR	612	0.06378	24	NR	99	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
34-500-WR-1	0.21	6.56	17.1	10.6	0.04	0.01	0.16	0.31	16.80	16.80	35.28	6.25	13.56	28.48

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L)
34-500-SW-1	1.9 U	1.5 U	5.3	0.046 U	6020	8.7 U	8.3 U	2.0 J	19.1 J	1.2	395	3.4 UJ	0.26 JX	16.9 U	0.36 JX	9.1 U	16.7
34-500-SW-2	2.1	1.5 U	4.9	0.046 U	5590	8.7 U	8.3 U	2.7 J	14.2 UJ	0.93 U	382	3.4 UJ	0.19 JX	16.9 U	0.21 UJX	9.1 U	15.5
34-500-AD-1	3.4	1.5 U	3.7	0.046 U	8850	8.7 U	8.3 U	2.4 J	34.4 J	11.9	496	3.4 UJ	0.15 JX	16.9 U	0.69 JX	9.1 U	24.1

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
34-500-SW-1	21	< 5	< 5	NR	NR
34-500-SW-2	17	< 5	5	NR	NR
34-500-AD-1	37	< 5	7	NR	NR

Legend

SE-1- 50 feet downstream of mine in tributary.
SE-2- 50 feet upstream of mine in tributary.
WR-1- Composite of WR1A & WR1B.
BACKGROUND- Taken from Poor Man/ Emma (49-001-SS1) (1993 data).
AD-1- Flowing adit at WR-1.
SW-1- Same as SE-1.
SW-2- Same as SE-2.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Emma Darling
Legal Description: T 7N R 8W
Mining District: Emery
Latitude: N 46° 23' 03"
Longitude: W 112° 34' 12"
Land Status: Public/Private
Quad: Baggs Creek
Inspectors: Tuesday, Flammang
Organization: Pioneer Technical Services, Inc.

County: Powell
Section(s): SW 1/4, NE 1/4, Section 2
Mine Type: Hardrock/Pb, Ag
Primary Drainage: Clark Fork River
USGS Code: 17010201
Secondary Drainage: Rocker Gulch/Cottonwood Creek
Date Investigated: September 16, 1995
P.A. # 39-027

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 10,700 cubic yards. The following elements were elevated at least three times background:
  Antimony: 126J mg/kg
  Arsenic: 5,140 mg/kg
  Cadmium: 44.5 mg/kg
  Copper: 239J mg/kg
  Lead: 2,230J mg/kg
  Mercury: 1.1 mg/kg
  Zinc: 2,020J mg/kg

- There were no discharging adits, filled shafts, seeps, or springs observed at the site during the investigation.

- No surface water flowed on or near the site during the investigation. The nearest surface water was 500 feet away; no surface water samples were collected.

- Potential safety hazards observed included a fenced open shaft, an open pit, and a loadout.

Emma Darling PA# 39-027
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/16/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
39-027-WR-1	126 J	5140	130	44.5	17800	20.5	25.9	239 J	78500	2230 J	8250	2200	1.1	10.0	101	2020 J	NR
BACKGROUND	7 UJ	91	295	3.5	NR	36.9	13.9	67.3	43400	43	NR	2960	0.165	7	NR	171	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
39-027-WR-1	3.40	106	149	43.0	<0.01	1.63	2.42	50.9	98.30	98.30	206.43	126.56	28.05	58.90

Legend

WR-1- Composite WR1A, 1B, 1C, 2A, 2B, 3A, 3B.
BACKGROUND- From the Emery Mine (39-004-SS1) (1993 data)

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Bonanza
Legal Description: T 7N R 8W
Mining District: Emery
Latitude: N 46° 22' 45"
Longitude: W 112° 34' 12"
Land Status: Private
Quad: Baggs Creek
Inspectors: Tuesday, Flammang
Organization: Pioneer Technical Services, Inc.

County: Powell
Section(s): NE 1/4, NW 1/4, Section 11
Mine Type: Hardrock/Au, Pb, Ag
Primary Drainage: Clark Fork River
USGS Code: 17010201
Secondary Drainage: Rocker Gulch/Cottonwood Creek
Date Investigated: September 16, 1995
P.A. # 39-501

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 9,300 cubic yards. The following elements were elevated at least three times background:
  Arsenic: 8,350 mg/kg
  Lead: 4,120J mg/kg
  Zinc: 4,390J mg/kg
  Cadmium: 38 mg/kg
  Mercury: 0.69J mg/kg

- There were no discharging adits, filled shafts, seeps, or springs observed at the site during the investigation.

- No surface water flowed on or near the site during the investigation. The nearest surface water was over 1,000 feet away; no surface water samples were collected.

- Potential safety hazards observed included an open incline, two buildings, two loadouts, and steep slopes on WR-1.

Bonanza Mine PA# 39-501
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/16/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
39-501-WR-1	13.3 J	8350	17.4	38.0	44200	10.9	14.5	62.6 J	49100	4120 J	17300	4400	0.69	15.8	29.1	4390 J	NR
BACKGROUND	7 UJ	91	295	3.5	NR	36.9	13.9	67.3	43400	43	NR	2960	0.165	7	NR	171	NR

U- Not Detected; J- Estimated Quantity, X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
39-501-WR-1	5.00	156	138	-18.3	<0.01	1.91	3.54	59.7	78.20	78.20	164.22	170.31	-40.39	-84.82

Legend

WR-1- Composite 1A, 1B, 2(1B), 2A, 2C.
BACKGROUND- From the Emery Mine (39-004-SS1) (1993 data)

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Hidden Hand	County: Powell
Legal Description: T 7N R 8W	Section(s): NE 1/4, SE 1/4, Section 3
Mining District: Emery	Mine Type: Hardrock/Au
Latitude: N 46° 23' 28"	Primary Drainage: Clark Fork River
Longitude: W 112° 33' 31"	USGS Code: 17010201
Land Status: Public	Secondary Drainage: Baggs Creek/Cottonwood Creek
Quad: Baggs Creek	
Inspectors: Tuesday, Flammang	Date Investigated: September 17, 1995
Organization: Pioneer Technical Services, Inc.	P.A. # 39-502

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 7,700 cubic yards. The waste rock was in direct contact with water from the adit discharge and in an intermittent drainage. The following elements were elevated at least three times background:

Antimony: 24.3J to 22.9J mg/kg	Arsenic: 2,030 to 2,510 mg/kg
Lead: 4,060J to 4,570 mg/kg	Mercury: 0.56 mg/kg
Zinc: 547J mg/kg	

- One discharging adit was observed at the site which flowed over and through WR-4. No acute or chronic aquatic life criteria or MCLs were exceeded. The pH was 7.53.

- Surface water was collected downstream from the adit discharge and WR-4 in a tributary of Baggs Creek. Acute and chronic aquatic life criteria were exceeded for zinc. Chronic aquatic life criteria was exceeded for cadmium, and the MCL for cadmium was exceeded.

- Potential safety hazards observed at the site included four open adits, an open shaft, a partially collapsed cabin, a loadout, and a trench associated with a collapsed adit.

Hidden Hand Mine PA# 39-502
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/17/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
39-502-SE-1	7.4 UJ	401	225	56.6	6390	76.0	54.7	85.8 J	60800	1060 J	17100	5210	0.061	37.2	2.3	4610 J	NR
39-502-WR-1	22.9 J	2510	81.7	0.55	2620	29.2	3.9	33.7 J	57600	4570 J	7380	267	0.28	4.5	17.5	185 J	NR
39-502-WR-2	24.3 J	2030	107	3.6	11700	35.3	22.8	57.5 J	52400	4060 J	8630	924	0.56	9.0	16.6	547 J	NR
BACKGROUND	7 UJ	91	295	3.5	NR	36.9	13.9	67.3	43400	43	NR	2960	0.165	7	NR	171	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
39-502-WR-1	1.42	44.4	-1.54	-45.9	1.37	0.02	0.03	0.62	-2.17	-2.17	-4.56	33.68	-44.02	-92.44
39-502-WR-2	1.43	44.7	0.69	-44.0	1.27	0.03	0.13	0.94	-0.24	-0.24	-0.50	34.77	-42.60	-89.46

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Al (ug/L)	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
39-502-SW-1	259 JX	3.9 J	7.7	12.5	5.9	60200	9.6 U	10.9 U	4.4 U	309	7.4	16500	65.0	0.16 U	13.9 U	0.64	548	218
39-502-AD-1	141 JX	5.8 J	19.8	15.1	1.8	83300	9.6 U	10.9 U	4.4 U	326	0.58 U	21200	845	0.16 U	13.9 U	0.56	111	295

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
39-502-SW-1	446	< 5	178	NR	NR
39-502-AD-1	64	< 5	170	NR	NR

Legend

SE-1- Tributary of Baggs Creek below adit discharge and WR4.
WR-1- Composite of WR1A, 1B, 2A, 2B, (upper dumps).
WR-2- Composite of WR3A, 3B, 3C, 4A, 4B , (middle & lower dumps)
BACKGROUND- From the Emery Mine (39-004-SS1) (1993 data).
AD-1- Adit associated with WR-4.
SW-1- Same as SE-1.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Spring Creek Tailings
Legal Description: T 7N R 8W
Mining District: Emery
Latitude: N 46° 22' 05"
Longitude: W 112° 34' 29"
Land Status: Public
Quad: Sugarloaf Mountain
Inspectors: Tuesday, Clark, Liebelt
Organization: Pioneer Technical Services, Inc.

County: Powell
Section(s): NE 1/4, SW 1/4, Section 11
Mine Type: Millsite/Au
Primary Drainage: Clark Fork River
USGS Code: 17010201
Secondary Drainage: North Fork Cottonwood Creek/Spring Creek
Date Investigated: November 13, 1995
P.A. # 39-503

- The volume of tailings associated with the site was approximately 7,700 cubic yards. Surface water from Spring Creek flowed through the tailings. The following elements were elevated at least three times background:

Antimony: 337 to 602 mg/kg	Arsenic: 6,960 to 13,400 mg/kg
Cadmium: 99.2J to 55.2J mg/kg	Copper: 244 to 359 mg/kg
Lead: 4,900J to 5,320J mg/kg	Manganese: 17,400J mg/kg
Zinc: 6,490J to 9,230J mg/kg	

- There were no discharging adits, filled shafts, seeps, or springs observed at the site during the investigation.

- Surface water from Spring Creek flowed through the site. Chronic aquatic life criteria was exceeded for lead. No acute aquatic life criteria were exceeded. The MCL was exceeded for antimony.

- Observed releases to Spring Creek (sediment) were documented for antimony, arsenic, cadmium, copper, lead, manganese, and zinc; the water had documented releases attributable to the site for arsenic, cadmium, lead, and manganese.

- No potential safety hazards were observed at the site during the investigation.

Spring Creek Tailings PA# 39-503
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/14/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
39-503-SE-1	134	3110 J	93.3	30.9 J	12700	46.2 J	16.3	133	44700 J	1650 J	11200	8250 J	0.14	16.8	21.8 J	3750 J	NR
39-503-SE-2	8.7 U	114 J	74.6	2.1 J	6090	35.3 J	22.6	39.8	40500 J	62.4 J	15200	760 J	0.046 U	48.6	1.2 U	437 J	NR
39-503-TP1	337	6960 J	63.9	55.2 J	31800	37.0 J	14.3	244	54600 J	4900 J	17900	5750 J	0.40	13.5	60.7 J	6490 J	<0
39-503-TP2	602	13400 J	39.5	99.2 J	26300	16.1 J	11.6	359	57800 J	5320 J	12100	17400 J	0.31	3.2 U	96.3 J	9230 J	1
BACKGROUND	7 UJ	91	295	3.5	NR	36.9	13.9	67.3	43400	43	NR	2960	0.165	7	NR	171	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
39-503-TP1	2.34	73.1	95.3	22.2	<0.01	1.98	0.46	61.9	33.4	33.40	70.14	76.25	23.81	50.01
39-503-TP2	3.72	116	105	-11.5	<0.01	2.99	1.38	93.4	11.3	11.30	23.73	136.56	-39.45	-82.85

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
39-503-SW-1	10.4 J	50.4	13.4	0.77 J	50300	9.8	8.3 U	2.8 J	190	35.5 J	12500	46.5 J	0.14 U	16.9 U	0.21 U	78.0	177000
39-503-SW-2	3.5 J	7.2	12.3	0.22 J	48900	8.7 U	8.3 U	2.0 U	25.3	0.93 U	12300	5.8 J	0.14 U	16.9 U	0.21 U	34.4	173000

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
39-503-SW-1	250	< 5	95	NR	NR
39-503-SW-2	242	< 5	87	NR	NR

Legend

SE-1- In Spring Creek, 100' downstream from main tailings impoundment.
SE-2- In Spring Creek, 100' upstream from site.
TP1- Composite of subsamples TP1A-1 and TP1B-1.
TP2- Composite of subsamples TP1A-2, TP1B-2, and TP1B-3.
BACKGROUND- From the Emery Mine (30-004-SS-1) (1993 data).
SW-1- Same as SE-1.
SW-2- Same as SE-2

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: S & H
Legal Description: T 18N R 26W
Mining District: Plains
Latitude: N 47° 19' 35"
Longitude: W 114° 56' 20"
Land Status: Public
Quad: Keystone Peak
Inspectors: Tuesday, Flammang
Organization: Pioneer Technical Services, Inc.

County: Sanders
Section(s): SE 1/4, SW 1/4, Section 8
Mine Type: Hardrock/Cu, Ag
Primary Drainage: Clark Fork River
USGS Code: 17010204
Secondary Drainage: Clark Fork River
Date Investigated: October 7, 1995
P.A. # 45-017

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 75 cubic yards. The waste rock was located adjacent to flow from the adit discharge. The following elements were elevated at least three times background:
  Copper: 622J mg/kg
  Lead: 99.4J mg/kg
  Barium: 51.7 mg/kg
  Iron: 15,400 mg/kg
  Mercury: 0.23J mg/kg

- One discharging adit was observed at the site which flowed adjacent to the waste rock and into the Clark Fork River. The chronic aquatic life criteria was exceeded for mercury. No acute aquatic life criteria or MCLs were exceeded. The pH was 7.15.

- Surface water flow from the Clark Fork River was near the site. However, no samples were collected due to the large volume of water in the river with respect to the negligible amount contributed from the site.

- Potential safety hazards observed at the site included an adit opening and a highwall above the adit opening.

S & H PA# 45-017
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 10/7/95

SOLID MATRIX ANALYSES

Metals In soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
45-017-WR-1	4.1 UJX	14.1 J	51.7	0.43 U	208	2.4 J	1.4 U	622 J	15400	99.4 J	1820	30.4	0.23 J	5.8 JX	1.6	16.2	NR
BACKGROUND	5.39 U	7.89	8.8	0.5 U	NR	1.2 U	3.31	2.44 J	3120	7.59 J	NR	609	0.00965 UJ	2.22 U	NR	11.9	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
45-017-WR-1	0.44	13.7	0.92	-12.8	0.05	0.01	0.38	0.31	0.61	0.61	1.28	13.36	-15.55	-32.65

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
45-017-AD-1	3.2	1.5 U	111	0.046 U	23000	8.7 U	8.3 U	7.2 J	19.1 J	0.93 U	6220	4.5 J	0.23 JX	16.9 U	0.99 JX	21.5	83.1

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
45-017-AD-1	114	< 5	16.0	NR	NR

Legend

WR-1- Composite of WR1A, 1B.
BACKGROUND- Taken from Nancy Lee Mine (31-001-SS1) (1993 data).
AD-1- Adit discharge near WR-1.

6.0 REFERENCES

MBMG, 1994. Montana Bureau of Mines and Geology, Well Logs Database, July 14, 1994.

MDEQ/AMRB-Pioneer, 1994a. Sampling and Analysis Plan for the Abandoned Mines Hazardous Materials Inventory, May 1994.

MDEQ/AMRB-Pioneer, 1994b. Quality Assurance Project Plan for the Abandoned Mines Hazardous Materials Inventory, May 1994.

MDEQ/AMRB-Pioneer, 1994c. Laboratory Analytical Protocol for the Abandoned Mines Hazardous Materials Inventory, May 1994.

MDEQ/AMRB-Pioneer, 1994d. Health and Safety Plan for the Abandoned Mines Hazardous Materials Inventory, May 1994.

MDEQ/AMRB-Pioneer, 1994e. Abandoned Hardrock Mines Project Report for the Abandoned Hardrock Mine Priority Sites, December 1994.

MDEQ/WQB, 1995. Montana Department of Environmental Quality/Water Quality Bureau, Circular WQB-7, Montana Numeric Water Quality Standards, July 15, 1995.

MDFWP, 1989. Montana Department of Fish, Wildlife and Parks, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.

GLOSSARY

Abandoned Mine; Abandoned Workings - Excavations, either open, caved, or sealed, that are deserted and in which further mining is not intended.

Acid Mine Water - Mine water which contains sulfuric acid, mainly due to the oxidation of iron pyrite.

Acidity - Estimate of the capacity for a neutral water to neutralize caustic wastes without disturbing biological activities.

Activator (floatation mill) - A reagent that facilitates floatation of selected mineral species in a flotation cell.

Acute Aquatic Life Criteria - EPA's maximum acute toxicity concentrations for protection of aquatic life and its uses as established under Section 304(a)(1) of the Clean Water Act, as amended.

Adit - A horizontal or nearly horizontal passage driven in rock from the surface of the working or dewatering of a mine.

Alkalinity - Estimate of the capacity for a neutral water to neutralize acidic wastes without disturbing biological activities.

Alluvium - Sediments deposited on land by streams and rivers.

AIMSS - Abandoned and Inactive Mines Scoring System.

Amalgamation - The process by which mercury is alloyed with some other metal to produce an amalgam. Used at one time for the extraction of gold and silver from pulverized ores.

Attribution - To document an observed release of a hazardous substance(s) to the environment, the presence of the hazardous substance(s) must be attributable to a waste source at the site. For example, if an observed release to surface water can be established for copper, the concentration of copper in any waste source at the site must exist at greater than three times the background concentration of copper to establish attribution to the site.

Ball Mill - A rotating horizontal cylinder in which nonmetallic materials are ground using various types of grinding media such as quartz pebbles, porcelain balls, or steel balls.

Barren Solution - Leaching solution that has been chemically stripped of metal values. Typically, the barren solution is recharged with leaching agent and recycled.

Benefication - The processing of ores for the purpose of (1) regulating the size of a desired product, (2) removing unwanted constituents, and (3) improving the quality, purity, or assay grade of a desired product.

BLM - United States Department of Interior, Bureau of Land Management.

Bore Hole - An exploratory or prospecting hole made by drilling.

CECRA - The Comprehensive Environmental Cleanup and Responsibility Act.

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act of 1980, also known as Superfund: Amended in 1986 by the Superfund Amendments and Reauthorization Act (SARA).

Chronic Aquatic Life Criteria - EPA's maximum chronic toxicity concentrations for protection of aquatic life and its uses as established under Section 304(a)(1) of the Clean Water Act, as amended.

Claim - An area of land claimed by an individual or corporation for the ultimate purpose of mineral extraction. The dimensions of a lode claim are 600 by 1,500 feet; for a placer claim, 600 by 1,320 feet.

Collar - The term applied to the timbering or concrete around the mouth or top of a shaft. The junction of a mine shaft with the surface.

Collector (floatation mill) - A reagent that aids or facilitates the attraction of mineral particles to the froth in a floatation cell.

Comminution - To reduce solids to minute particles by crushing and grinding to liberate metals.

Concentrate - To separate metal or ore from the associated gangue or barren rock.

Concentrate (mineral concentrate) - Enriched ore after the removal of waste in a benefication mill.

Concentrator - Mill or plant in which ore is concentrated by removing unwanted constituents.

Containment - Engineered structures designed to prevent releases to groundwater, such as liners, covers, and run-on diversions.

Country Rock - General term applied to the rock surrounding and penetrated by mineralized veins; in a wider sense applied to the rocks invaded by and surrounding an igneous intrusion.

Cribbing - A method of timbering used primarily to rectify the removal of too great a percentage of the rock on the advance, and has the effect of replacing part of the rock.

Crosscut - (1) A passageway driven at right angles to the main entry to connect it with a parallel entry of air course. (2) A horizontal opening driven across the course of a vein or in general perpendicular to the direction of the main workings.

Crusher - A machine for crushing rock or other materials. Among the various types of crushers are the ball-mill, gyratory crusher, Hadsel mill, jaw crusher, rod mill, rolls, stamp mill, and tube mill.

Cyanide - A salt or ester of hydrocyanic acid. In aqueous solution, cyanide is used to dissolve metal from gangue material for later recovery.

Cyclone - A device for classification by centrifugal means of fine particles suspended in water, whereby the coarser grains collect and are discharged at the apex of the vessel, while the finer particles are eliminated with the bulk of the water at the discharge orifice.

Depressant (floatation mill) - A reagent that causes selected mineral species to sink in a floatation cell.

DNRC - Montana Department of Natural Resources and Conservation.

Drainage Basin Code - Code assigned to each discrete hydrologic unit by the U.S. Geological Survey.

Drift - A horizontal passage underground. A drift follows the vein, as distinguished from a crosscut, which intersects it.

Dump - A pile or heap of waste rock material or other non-ore refuse near a mine.

Electrowinning - Recovery of a metal from an ore or solution by electrochemical processes.

EPA - United States Environmental Protection Agency.

Face - The surface exposed by excavation. The working face, front, or forehead is the face at the end of the tunnel heading, or at the end of the full size excavation.

Floatation - The method of mineral separation which a froth created in water by a variety of reagents floats some finely crushed minerals, whereas other mineral sink.

Floatation Cell - Device in which froth floatation of ores is performed. It has provisions for receiving conditioned pulp, aerating the pulp, and for separate discharge of the resulting mineralized froth and impoverished tailings.

Floodplain - An alluvial plain caused by the overbank deposition of alluvial material. They typically appear as flat expanses of land bordering a stream or river. Most floodplains are accompanied by a series of alluvial terraces of varying levels.

Fluvial - Pertaining to or produced by the action of a stream or river.

Frother - A reagent which serves to stabilize the froth in a floatation cell until it can be scraped off into the concentrate launder.

Glory Hole - Large, open hole typically associated with a mined-out or widened shaft.

Gravity Mill - A process in which heavy metals or minerals are separated from waste by the action of agitation and gravity on materials suspended in a liquid, usually water.

Grizzly - A devise used for coarse screening of bulk materials. A rugged screen for rough sizing at a comparatively large size (for example, 6-inches); it can comprise fixed or moving bars, disks, or shaped tumblers or rollers.

Hand Auger - A large tool modeled after the carpenter's drill used in soil sampling.

HRS - EPA's Hazard Ranking System (Federal Register, Vol. 55, No. 241, pp. 51532-51667).

Hazardous Substance - CERCLA hazardous substances, pollutants, and contaminants as defined in CERCLA Sections 101(14) and 101(33).

Headframe - The vertical steel or timber frame at the top of a shaft, which carries the sheave or pulley for the hoist.

Heavy Metal - Principally the metals zinc, copper, cobalt, and lead; however, may include one or more of the following metals: bismuth, cadmium, gold, indium, iron, manganese, mercury, nickel, palladium, silver, thallium, and tin (often included, though not a metal).

Highwall - The unexcavated face of exposed overburden and coal or ore in an open-cast mine or the face or bank on the uphill side of contour strip mine excavation.

Hoist - (1) A drum on which wire rope is wound in the engine house, as the cage or skip is raised in the hoisting shaft. (2) An engine with a drum used for winding up a load from a shaft.

Inclined Shaft or Incline - A non-vertical shaft; usually along the dip of a vein.

Intermittent Stream - A stream or stretch of stream which flows only at certain times of the year when it receives water from springs, snow melt or storm runoff.

Jaw Crusher - A primary crusher designed to reduce large rocks or ores to sizes capable of being handled by a secondary crusher. It consists of a moving jaw, hinged at one end, which swings toward and away from a stationary jaw in a regular oscillatory cycle.

Jig (Mineral Jig) - A machine in which the feed is stratified in water by means of a pulsating motion and from which the stratified products are separately removed, the pulsating motion usually being obtained by alternate upward and downward currents of water.

Latitude - The angular distance north or south from the equator of a point on the earth's surface, expressed in degrees.

Leaching - (1) The removal in solution of the more soluble minerals by percolating waters. (2) Extracting a soluble metallic compound from an ore by selectively dissolving it in a suitable solvent, such as water, sulfuric acid, hydrochloric acid, cyanide, etc.

Legal Description - The Township, Range, Section, and typically quarter/quarter section location.

Level - A main underground roadway or passage driven along the level course to afford access to the stopes or workings and to provide ventilation and haulageways for the removal of ore.

Loadout - A receptacle for ore awaiting treatment or shipment, also referred to as an ore bin.

Longitude - An angular distance east or west from the meridian of some particular place to the prime meridian at Greenwich, England.

MCL - Maximum contaminant level: Established under the Safe Drinking Water Act.

MCLG - Maximum contaminant level goal: Established under the Safe Drinking Water Act.

Master Inventory - Inventory of all identifiable abandoned or inactive hardrock mine sites in Montana conducted by the MDEQ/AMRB.

Mesh - The number of openings per unit area of a screen (sieve).

Mill - A mineral treatment plant in which crushing, grinding, and further processing of ore is conducted to produce a product.

Milling - The processing of ore to produce a product.

Mine - Excavation of earth for the extraction of ore or other economic minerals.

Mine Development - The term used to describe the operations involved in preparing a mine for ore extraction. These operations may include tunneling, sinking, crosscutting, drifting, and raising.

Mineral - An inorganic substance occurring in nature, though not necessarily of inorganic origin, which has (1) a definite chemical composition or, more commonly, a characteristic range of composition, and (2) distinctive physical properties or molecular structure.

Mineral Deposit - A surface or underground body of mineral matter that may be utilized for its industrial mineral or metal content.

Mineral Dressing - Physical and chemical concentration of raw ore into a product from which a metal can be recovered for a profit.

MBMG - Montana Bureau of Mines and Geology.

MDEQ/AMRB - Montana Department of Environmental Quality/Abandoned Mine Reclamation Bureau.

MDEQ/ERD - Montana Department of Environmental Quality/Environmental Remediation Division.

MDEQ/WQB - Montana Department of Environmental Quality/Water Quality Bureau.

Observed Release - Concentration of hazardous substance(s) has increased significantly (greater than three times) above the background concentration for the site for that specific type of sample. For example, to document an observed release to surface water, a contaminant concentration detected in a surface water sample collected downstream from a site must exceed the concentration detected in a surface water sample collected upstream from the site by more than three times. See also "Attribution".

Open Pit Mining - A form of operation designed to extract minerals that lie near the surface.

Open Stope Method - Stoping in which no regular artificial method of support is employed, although occasional props or cribs may be used to hold local patches of insecure ground. Usually confined to relatively small, narrow ore bodies.

Ore - A mineral, or mineral aggregate, containing precious or useful metals, and which occurs in such quantity, grade, and chemical combination as to make extraction commercially profitable.

Ore Bin - A receptacle for ore awaiting treatment or shipment, also referred to as a loadout.

Ore Body - A solid and fairly continuous mass of ore, which may include low-grade ore and waste, as well as high-grade material.

Ore Deposit - A general term applied to rocks containing minerals of economic value in such amount that they can be profitably tracted.

Oxidation/Reduction Potential - The hypothetical electron activity at equilibrium. A measurement of the relative tendency (potential) of a solution to accept or transfer electrons, measured in volts.

Perennial Stream - A stream or stretch of a stream that flows continuously throughout the year.

pH - A measure of the degree of acidity or basicity of a solution. At 25°C, a pH of 7 is neutral. Acidity increases as measurements decrease below 7, and basicity increases as measurements increase above 7.

Placer - A mineral concentration resulting from weathering processes, usually involving water. Placer deposits are typically composed of heavy minerals, with gold, platinum, tin, and diamonds being the most important.

Ponded - A condition in which free water covers the soil surface, as in a closed depression.

Portal - (1) The surface entrance to a drift, tunnel, or adit; (2) The entrance to a mine.

PRP - Potentially Responsible Party.

Pregnant Solution - Metal-laden solution (cyanide, acid, etc.) resulting from a leach process.

Primary Drainage - The primary drainage is the smallest named stream segment/drainage basin that is locatable on the USGS Hydrologic Unit Map within which the mine site is located.

PA No. - Problem Area Number established by the MDEQ/AMRB.

Prospect - (1) A mineral property, the value of which has not been proved by exploration. (2) Non-producing mining property under development or considered worthy of such attention.

Pulp - A mixture of ground ore and water capable of flowing through suitably graded channels as a fluid.

QA/QC - Quality Assurance/Quality Control.

Raise - A vertical or inclined opening driven upward from a level to connect with the level above, or to explore the ground for a limited distance above one level.

Reagent - A chemical or solution used to produce a desired chemical reaction; a substance used in assay or floatation.

Rod Mill - A mill for fine grinding, employing long steel rods to grind the material.

Secondary Drainage - The secondary drainage is the smallest named stream segment/drainage that is locatable on the USGS Quadrangle Map within which the mine site is located.

Sediment - Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, or ice and has come to rest on the earth's surface either above or below the water level.

Sedimentation - The settling of solid particles of soil, coal, or mineral from liquid as a result of gravity or centrifuging.

Shaft - An excavation of limited area compared with its depth, made for access to underground mine workings.

Sluice (Sluice Box) - A long trough-like box set at an incline of about 1:20 through which placer gravel is carried by a stream of water. The gravel is washed away while most of the gold or other heavy materials are caught by riffles or blankets on the floor of the sluice.

Slurry - Fine solid particles suspended in a liquid, typically water, of a consistency that allows flow by gravity or pumping.

Source - Any area where a hazardous substance has been deposited, stored, disposed, or placed, plus those soils that have become contaminated from migration of a hazardous substance.

Specific Conductance - The specific conductance or conductivity of water (or other substance measured) is the electrical conductance of the material between opposite sides of a cube 1 centimeter in each direction.

Stamp Mill - An apparatus in which rock is crushed by a stamp battery.

Stope - An underground excavation from which ore has been removed.

Subsidence - A sinking down of a part of the earth's surface due to the collapse of underlying underground openings.

Surface Mining - The mining in surface excavations, including placer mining, mining in open pits, mining and removing ore from open cuts by hand or with mechanical excavating and transportation equipment, and the removal of overburden to uncover the ore.

Tailings - The refuse material resulting from the washing, concentration, or treatment of ground ore.

Tailings Pond - A pond with a constraining wall or dam to which mill effluents are run.

Tunnel - A horizontal or nearly horizontal underground passage that is open to the atmosphere at both ends.

USFS - United States Department of Agriculture, Forest Service.

USGS - United States Department of Interior, Geological Survey.

Waste - The rock that is too low in grade to be of economic value.

Waste Dump (Spoil Pile) - The area where mine wastes or spoil materials are discarded.

Wetlands - Areas that under normal circumstances have hydrophytic vegetation, hydric marshes, and wetland hydrology. It includes landscape units such as bogs, marshes, and lowlands covered with shallow ephemeral or intermittent waters. Permanent waters of streams and water deeper than 9 feet in lakes or reservoirs are not considered wetlands.

Winze - A vertical or inclined opening, or excavation, connecting two levels in a mine, differing from a raise only in construction. A winze is driven downward and a raise is excavated upward.

X-ray Fluorescence (XRF) Spectrometer - Instrument used for metals analysis of solid media by energy dispersive X-ray fluorescence.

DATA VALIDATION
AND EVALUATION REPORT

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU

ABANDONED HARDROCK MINE PRIORITY SITES

1995
DATA VALIDATION AND EVALUATION REPORT

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1.0 INTRODUCTION

This document is a summary of the validation and evaluation of the analytical data collected during the 1995 Montana Department of Environmental Quality/Abandoned Mine Reclamation Bureau (MDEQ/AMRB), Abandoned Mines Hazardous Materials Inventory; as well as the Reclamation Investigations for the National Extension/Sallie Belle site, the Peerless Jenny-King/Queensbury site, and the Maxville Tailings/Londonderry Mine site. The Hazardous Materials Inventory and Reclamation Investigations were conducted during the summer and fall of 1995. The 1995 Inventory supplements the 1993 and 1994 Hazardous Materials Inventories. The data discussed in this report represent the analytical results of source (tailings, waste rock, slag, etc.), soil, sediment, surface water, and groundwater samples. The data include the analytical results reported by the laboratory, as well as data provided by the field portable X-Ray Fluorescence (XRF) Spectrometer. Pioneer Technical Services, Inc. (Pioneer), has prepared this Data Validation and Evaluation Report for MDEQ/AMRB under the provisions of the Engineering Services Agreement DEQ-AMRB No. 94-006.

The objectives of the Data Validation and Evaluation Report include:

- summarize the laboratory data validation process according to U.S. Environmental Protection Agency (EPA) guidelines;
- summarize the XRF data validation process, performed according to guidelines provided by the instrument manufacturer;
- evaluate the laboratory data using a precision, accuracy, representativeness, completeness, and comparability (PARCC) statement according to EPA guidelines; and
- evaluate the overall precision and representativeness of the field XRF data using standard statistical comparison techniques, and compare field-generated XRF data to analytical laboratory generated data.

2.0 DATA VALIDATION

Data validation is the process of determining the limitations of analytical data after the data have been reported by the laboratory or the XRF spectrometer. The analytical laboratory utilized for this investigation (MSE, Inc.) complied with the EPA's Contract Laboratory Program (CLP) Statement of Work (SOW). The CLP SOW outlines reporting and deliverable requirements, analytical methods, quality assurance/quality control (QA/QC) procedures, etc. The MSE Laboratory complied with all of the QA/QC performance requirements defined in the CLP SOW when analyzing the samples for this investigation; however, the data packages did not include the extensive QA/QC documentation specified by the CLP SOW. The requested deliverable packages were modified to avoid unnecessary costs, yet still provide sufficient QA/QC information to allow comprehensive data validation and evaluation. Data evaluation occurred at the project office where a reviewer assessed the data by using the data validation guidelines developed by the EPA. The data validation process applied limitations to specific analytical data if certain conditions outlined in the EPA guidance documents were not met.

The limitations applied to the data were identified by data qualifiers (Table 2-1). Understanding the limitations of the data assists the data user when making interpretations. Data with limitations (flagged data) are usable for interpretive purposes provided that the qualifications are considered. For example, a "J" flag indicates that the reported concentration was estimated (the laboratory did not meet the specified control limits for accuracy or precision, or a contaminant was detected above a certain level in a preparation blank, etc.). "J" flagged data meets the identification criteria (the analyte was definitely detected), but not the quantitation criteria (the concentration cannot be exactly quantified). After the validation process was complete, the data could be assigned into data use categories including: unrestricted (data receiving no qualification); restricted (qualified/flagged data); and unusable (unrepresentative or "R" flagged data).

The laboratory data validated and evaluated for these investigations included a list of up to 23 metals from the CLP Target Analyte List (TAL). A total of 15 soil sample batches (177 individual samples) and 21 water sample batches (134 individual samples) were analyzed at the laboratory over the duration of the investigations; and 375 soil/sediment samples were analyzed in the field using the field portable XRF spectrometer.

The QA/QC performance requirements specified for laboratory data by the CLP were administered on a per batch basis with a restricted number of samples analyzed per batch (maximum of 20 samples per batch). For example, a laboratory preparation blank, laboratory duplicate, and matrix spike, etc., were analyzed with each batch, and the results of these QA/QC analyses were applicable to the entire batch.

When a sample was analyzed in the field using the XRF spectrometer, the analysis would take several minutes to complete; the exact length of time was controlled by the operator. The XRF instrument contains three radioactive sources (Fe55, Cd109, and Am241). These sources allow the quantification of the following elements: Fe55 - Cr; Cd109 - Cr, Mn, Ni, Cu, An, As, Hg, Pb; and Am241 - Cd. The analysis time was developed to maximize the exposure of the sample to the Cd109 source, since most of the analytes of concern are quantified using this source, yet keep the total analysis time under 10 minutes. Throughout the duration of each analysis, the XRF would

TABLE 2-1

INORGANIC DATA QUALIFIERS

DATA QUALIFIERS

[1]U - The material was analyzed for, but was not detected at the level of the associated value. The associated value represents the instrument detection limit (IDL).

[1]J - The associated value was an estimated concentration; the laboratory did not meet all required QA/QC objectives (e.g. precision and/or accuracy results outside control limits).

[1]R - The data were rejected as unusable; the flagged analyte may or may not be present (e.g. sample holding times exceeded, instrument not properly calibrated or not calibrated at specified frequency, laboratory QC samples outside control limits, etc.).

[1]UJ- The analyte was analyzed for, but was not detected. The associated value was an estimate and may be inaccurate or imprecise.

X - Data outlier based on statistical analysis of the entire data set. Data qualified with an "X" were not considered when determining overall precision and accuracy statements.

[1] From Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (USEPA, 1988).

analyze the sample several times and store several concentrations for each analyte in memory. When the analysis was complete, the concentration reported by the XRF represented the mean of the concentrations stored in memory for each analyte for a particular sample. The standard deviation was also reported with the mean concentration for each analyte.

The XRF data were validated by a data reviewer; the validation procedure consisted of comparing the reported concentration with the associated standard deviation. Per the instrument manufacturer's guidelines, any concentration that was less than three times (3X) the corresponding standard deviation was considered to be below the instrument detection limit (or not distinguishable from background) and was not reported. Those XRF data reported where the concentration was greater than 3X but less than 10X the standard deviation were flagged with a "*", indicating an estimated concentration. A "*" flag applied to XRF data is basically equivalent to a "J" flag applied to laboratory data (indicating an estimated concentration); however, the criteria used to apply each of these flags are different.

If the sample standard deviation information was not available for review (possibly omitted during the data downloading process, or hand recorded data was available for review without the associated standard deviation values), the XRF data were flagged with a "$", indicating that the data could not be properly validated according to the applicable criteria.

2.1 LABORATORY DATA VALIDATION RESULTS

The laboratory data were validated according to the document Laboratory Data Validation Functional Guidelines for Evaluating Inorganics (EPA, 1988). The data validation procedures were performed partially by the laboratory chemists, and partially by a Pioneer data reviewer. The overall data validation procedure included an evaluation of the following items:

- holding times;
- initial and continuing calibrations;
- calibration and preparation blanks;
- inductively coupled plasma (ICP) interference check samples;
- laboratory control samples (LCS);
- laboratory duplicate sample analyses;
- matrix spike sample analyses;
- furnace atomic absorption (AA) quality control (QC);
- ICP serial dilutions;
- sample result verification;
- field duplicate samples; and
- overall assessment of data for the batch.

The following is a brief summary of the validation results for the soil (solid matrix) and water data reported for these investigations. The most intensive data validation procedures were performed on the data reported by the laboratory (in accordance with EPA Guidelines).

Holding time requirements were met for all water samples submitted to the laboratory. Holding time requirements have not been established for soil samples; however, if the water holding time criteria were applied to soil samples, no holding time exceedences occurred for soils. Additionally, all initial and continuing calibration requirements were met for soil and water samples for the entire data set (all sample batches). Typically, if the laboratory fails to meet the CLP-specified calibration requirements, samples are not analyzed until corrections are made and the calibration criteria are satisfied.
No contaminants were detected above the CLP Contract Required Detection Limit (CRDL) in water sample preparation blanks for the entire data set. However, one analyte (arsenic) was detected above the CRDL in one soil sample preparation blank. This resulted in flagging 6.7% of the arsenic data as estimated concentrations ("J" flag).

The requirements for running and meeting the control limits for ICP interference check samples were met for all soil and water samples, and Laboratory Control Sample (LCS) results were in control for all soil and water analyses. Typically, if the laboratory fails to meet these CLP-specified requirements, the affected samples are re-analyzed until the results for these QC samples are within the specified control limits.

Laboratory duplicate analyses yielded the following results. For the water analyses, the percentage of data qualified for each analyte where laboratory duplicate results were not within the CLP-specified control limits (± 20%) for concentrations >5x the CRDL are listed in Table 2-2 (the affected data were flagged "J"). Similarly, laboratory duplicate results for soil analyses that were not within the CLP-specified control limits (± 35%) for concentrations >5x the CRDL are also listed in Table 2-2 (the affected data were flagged "J").

Matrix spike results (water and soil) that were not within the CLP-specified accuracy range (75% - 125% for both matrices) caused the entire batch to be qualified with a "J" flag (for the specific analyte exceeding the control limit). Table 2-3 lists the percentage of data qualified for each analyte and media based on matrix spike results.

TABLE 2-2

DATA QUALIFIED DUE TO LABORATORY DUPLICATE RESULTS OUTSIDE CLP-SPECIFIED CONTROL LIMITS

Analyte	Qualified Water Data	Qualified Soil Data
Antimony	18%	20%
Arsenic	9%	40%
Barium	0%	27%
Cadmium	18%	27%
Chromium	14%	27%
Cobalt	0%	6%
Copper	13%	27%
Iron	13%	13%
Lead	23%	20%
Mercury	5%	27%
Manganese	13%	27%
Nickel	5%	13%
Silver	45%	40%
Zinc	5%	27%

TABLE 2-3

DATA QUALIFIED DUE TO MATRIX SPIKE RESULTS OUTSIDE CLP-SPECIFIED ACCURACY RANGE

Analyte	Qualified Water Data	Qualified Soil Data
Aluminum	0%	100%
Antimony	14%	87%
Arsenic	24%	25%
Barium	5%	20%
Beryllium	0%	0%
Cadmium	19%	20%
Chromium	0%	7%
Cobalt	0%	0%
Copper	0%	33%
Iron	0%	NA
Lead	29%	33%
Mercury	0%	29%
Manganese	0%	33%
Nickel	0%	100%
Selenium	15%	100%
Silver	10%	29%
Zinc	5%	38%
Thallium	8%	0%
Vanadium	0%	0%

The furnace AA QC requirements for duplicate injections and post digestion spikes and the ICP serial dilution requirements were met for all soil and water samples for the entire data set. Sample result verification determined that all soil and water quantitation results were accurate. An overall assessment of the data indicates that all data were usable with some limitations. More limitations were associated with the soil data due to usual matrix effects. The matrix effects were demonstrated by more frequent control limit exceedences for duplicate analyses and matrix spike analyses with soil analyses than with water analyses. The water data have relatively few limitations; the most frequent problem encountered with the water analyses was laboratory duplicate results outside CLP-specified control limits.

2.2 XRF DATA VALIDATION RESULTS

The XRF data were validated according to manufacturer specifications (currently no EPA guidelines exist for validating/evaluating XRF data) and the data that fell outside the manufacturer's guidelines were appropriately flagged or not reported. Table 2-4 lists the percentage of XRF data qualified for each analyte.

TABLE 2-4

PERCENTAGE OF XRF DATA QUALIFIED

Analyte	No. of Samples Above Detection Limit	Qualified Soil Data
Antimony	125	45%
Arsenic	240	28%
Barium	345	1%
Cadmium	29	100%
Calcium	347	8%
Chromium (Hi)	24	63%
Chromium(Lo)	29	100%
Cobalt	170	97%
Copper	205	64%
Iron	346	0%
Lead	334	9%
Manganese	197	57%
Mercury	26	46%
Molybdenum	161	71%
Nickel	32	100%
Potassium	345	2%
Rubidium	344	12%
Selenium	33	97%
Silver	196	96%
Strontium	340	13%
Thorium	200	91%
Tin	11	100%
Titanium	335	17%
Uranium	114	95%
Zinc	322	31%
Zirconium	346	6%

The criteria used to validate XRF data is very different from the criteria used to validate laboratory data. Laboratory data validation procedures are based on instrument performance while XRF data validation is based, indirectly, on the achieved detection limit on a sample for each individual analyte. Therefore, a high percentage of flagged data for a particular analyte listed on Table 2-4 indicates that a high percentage of the measured concentrations were relatively low (at or near the detection limit for the analyte). A high percentage of flagged XRF data does not necessarily indicate poor data quality.

3.0 DATA EVALUATION

Data evaluation was performed after the data validation process was completed and most of the limitations were applied to the data. The data evaluation process involved a statistical analysis of the data to identify outliers. The purpose of the data evaluation process was to prepare an overall PARCC statement as outlined in the document Statement of Work for Inorganics Analysis (EPA, 1988). The PARCC statement presents how much of the data meets the data quality objectives (DQOs) outlined in the Final Quality Assurance Project Plan (QAPjP) for the 1995 Abandoned Mines Hazardous Materials Inventory (MDEQ/AMRB-Pioneer, 1994a). The DQOs are qualitative and quantitative statements that specify the data quality required to support CERCLA-related activities.

3.1 PRECISION

Precision is a measure of the amount of scatter or variance that occurs among several measurements of a particular analyte on the same sample. The relative standard deviation (RSD) of the laboratory duplicate analyses was used to generate the overall precision statement for each analyte.

In addition to using the laboratory duplicate results to calculate overall precision statements for each analyte, overall precision was calculated for each analyte for the following types of analogous samples:

1) Field Duplicate - Field duplicate samples were collected only for the groundwater matrix during the investigations. No surface water or soil duplicates were collected; groundwater was expected to be the most homogeneous environmental media and was expected to provide the most comparable results. Field duplicates consisted of samples that were split in the field and submitted to the laboratory without being identified as such (blind). Field duplicate results are discussed further in Section 3.3.1 of this report.

2) XRF Field Duplicate - XRF field duplicates were applicable to the solid matrix only. XRF field duplicates consisted of samples that were analyzed twice in the field to determine the reproducibility of the XRF Spectrometer results. XRF field duplicates were generated by analyzing one discrete field subsample twice and reporting separate analyses, rather than two separate subsamples collected from

the field sample and analyzed individually. XRF field duplicate results are discussed further in Section 3.3.1 of this report.

3) XRF/Laboratory Splits - XRF/Laboratory splits were also applicable to the solid matrix only. XRF/Laboratory splits were analyzed in the field using the XRF Spectrometer, and a split of the sample was submitted to the laboratory for analysis. These split samples were expected to provide highly variable results due to the heterogeneous nature of the solid matrix and due to the very different analytical methods and associated detection limits (XRF spectrometry vs. acid extraction/atomic absorption). XRF/Laboratory split results are discussed further in Section 3.3.2 of this report.

The statistical methods used to calculate the overall precision statement for the laboratory data were discussed in the Final QAPjP for the 1995 Abandoned Mines Hazardous Materials Inventory (MDEQ/AMRB-Pioneer, 1994a) and are included as Appendix A to this report. Data acceptance or rejection was based on the application of the Dixon Q-Test, a statistical method that evaluates the relative standard deviation (RSD) calculated for laboratory duplicate analyses. A single duplicate analysis was conducted for each batch of soil and water samples analyzed at the laboratory for each analyte. Tables 3-1 and 3-2 present the overall precision statements for each analyte for the water and soil matrices, respectively; only laboratory duplicates were used in calculating the percent precision reported in Tables 3-1 and 3-2. Tables 3-1 and 3-2 also include the confidence interval with which the calculations were based and the overall completeness of the data. Completeness is a measure of the ratio of the number of duplicate pairs not evaluated as outliers compared to the overall number of duplicate pairs (number of sample batches not evaluated as outliers / total number of sample batches analyzed by the laboratory). Percent precision can be interpreted as follows: the concentration data for each analyte lie within the indicated percent precision (+/-) of the reported value.

Laboratory duplicates were generated at the laboratory by splitting a field sample prior to digestion or extraction, and analyzing the two splits as separate samples. The concentrations of the duplicate analyses were compared and the relative percent difference (RPD) between them was calculated and reported. For the evaluation of RPDs and RSDs, if a duplicate pair provided concentration results which were both less than the instrument detection limit (reported as "<IDL" by the laboratory), the RPD and RSD were evaluated as 0.0%. If only one of the duplicate results was "<IDL" and the other was a detected concentration, then the detected concentration and the IDL concentration were used to calculate the RPD and RSD. Table 3-3 presents the RPDs calculated for each analyte for the water matrix, for each sample batch, as reported by the laboratory. Table 3-4 presents the RPDs calculated for each analyte for the soil matrix, for each sample batch, as reported by the laboratory.

TABLE 3-1: PRECISION STATEMENT FOR WATER DATA USING THE LABORATORY DUPLICATE

ANALYTE	CONFIDENCE INTERVAL	COMPLETENESS/NUMBER OF OUTLIERS		PERCENT PRECISION	
		Total Metals	Dissolved Metals	Total Metals	Dissolved Metals
Aluminum	90%	86%/ONE	100%/NONE	+/- 5.61	+/- 0.66
Antimony	90%	100%/NONE	100%/NONE	+/- 5.86	+/- 3.93
Arsenic	90%	100%/NONE	80%/TWO	+/- 1.8	+/- 9.38
Barium	90%	100%/NONE	100%/NONE	+/- 1.07	+/- 1.77
Beryllium	90%	100%/NONE	100%/NONE	NA	+/- 3.03
Cadmium	90%	100%/NONE	100%/NONE	+/- 4.2	+/- 10.44
Calcium	90%	100%/NONE	100%/NONE	+/- 0.48	+/- 1.04
Chromium	90%	100%/NONE	100%/NONE	+/- 0.6	+/- 5.58
Cobalt	90%	100%/NONE	100%/NONE	+/- 0.12	+/- 1.14
Copper	90%	82%/TWO	90%/ONE	+/- 2.84	6.64
Iron	90%	100%/NONE	100%/NONE	+/- 3.06	+/- 6.79
Lead	90%	100%/NONE	90%/ONE	+/- 4.74	+/- 8.08
Magnesium	90%	100%/NONE	100%/NONE	+/- 0.49	+/- 1
Manganese	90%	100%/NONE	100%/NONE	+/- 3.8	+/- 6.33
Mercury	90%	91%/ONE	100%/NONE	+/- 3.95	NA
Nickel	90%	100%/NONE	89%/ONE	+/- 1.37	+/- 2.56
Potassium	90%	100%/NONE	100%/NONE	+/- 0.87	+/- 1.06
Selenium	90%	100%/NONE	83%/ONE	+/- 2.12	+/- 11.43
Silver	90%	82%/TWO	100%/NONE	+/- 19.07	+/- 8.92
Sodium	90%	100%/NONE	100%/NONE	+/- 0.84	+/- 0.95
Thallium	90%	83%/ONE	100%/NONE	+/- 6.51	+/- 0.67
Vanadium	90%	100%/NONE	100%/NONE	+/- 0.89	+/- 1.41
Zinc	90%	91%/ONE	100%/NONE	+/- 3.08	+/- 1.23

A 10% risk of false rejection was used to assess outliers
NA - Not Applicable

TABLE 3-2: PRECISION STATEMENT FOR SOIL DATA USING THE LABORATORY DUPLICATE

ANALYTE	CONFIDENCE INTERVAL	COMPLETENESS/NUMBER OF OUTLIERS	PERCENT PRECISION
Aluminum	90%	100%/ NONE	+/- 9.51
Antimony	90%	93%/ ONE	+/- 6.98
Arsenic	90%	100%/ NONE	+/- 10.15
Barium	90%	100%/ NONE	+/- 5.55
Beryllium	90%	100%/ NONE	+/- 13.41
Cadmium	90%	100%/ NONE	+/- 7.69
Calcium	90%	93%/ ONE	+/- 5.72
Chromium	90%	100%/ NONE	+/- 6.36
Cobalt	90%	100%/ NONE	+/- 4.82
Copper	90%	80%/ THREE	+/- 12.75
Iron	90%	93%/ ONE	+/- 4.97
Lead	90%	80%/ THREE	+/- 9.41
Magnesium	90%	100%/ NONE	+/- 7.00
Manganese	90%	93%/ ONE	+/- 8.07
Mercury	90%	100%/ NONE	+/- 6.1
Nickel	90%	93%/ ONE	+/- 4.63
Potassium	90%	100%/ NONE	+/- 8.35
Selenium	90%	100%/ NONE	+/- 13.33
Silver	90%	100%/ NONE	+/- 10.99
Sodium	90%	100%/ NONE	+/- 3.61
Thallium	90%	100%/ NONE	+/- 13.33
Vanadium	90%	100%/ NONE	+/- 6.25
Zinc	90%	100%/ NONE	+/- 7.77

A 10% risk of false rejection was used to assess outliers

TABLE 3-3: WATER DATA PRECISION REQUIREMENTS (RELATIVE PRECENT DIFFERENCE OF LABORATORY DUPLICATE) AND RESULTS

TOTAL METALS	Al	Sb	As	Ba	Be	Cd	Ca	Cr	Co	Cu	Fe	Pb
Required Precision (%)	20	20	20	20	20	20	20	20	20	20	20	20
Achieved Precision (%)												
Batch C1913	0.0	0.0	1.7	1.3	0.0	0.0	1.0	0.0	0.0	0.0	0.0	34.9
Batch C1914	0.0	0.0	5.5	0.9	0.0	72.2	1.0	24.7	0.0	0.0	0.0	16.0
Batch C1957	30.6	36.4	3.3	0.2	NA	6.0	0.4	0.0	0.0	0.0	14.0	7.6
Batch C1959	0.4	0.4	0.9	0.6	0.0	1.3	0.2	0.0	1.3	0.0	0.3	0.6
Batch C1959	0.4	0.4	0.9	0.6	0.0	1.3	0.2	0.0	1.3	0.0	0.3	0.6
Batch C1961	1.2	0.0	2.0	2.7	17.6	0.8	0.1	29.6	0.4	0.8	0.2	9.3
Batch C1970	NA	0.0	0.0	2.6	NA	0.0	0.6	0.0	0.0	0.0	6.0	9.4
Batch C1971	NA	0.0	4.4	0.9	NA	50.0	0.8	0.0	0.0	22.8	0.0	23.0
Batch C1975	NA	0.0	36.3	6.5	NA	4.4	4.6	0.0	0.0	2.8	1.7	24.8
Batch C1976	13.5	32.1	2.0	2.9	0.0	2.2	2.3	0.0	0.0	3.4	2.7	0.3
Batch C1980	0.0	0.0	8.4	0.3	0.0	26.1	0.9	4.1	8.2	58.7	0.0	3.8
Batch C1987	1.0	0.0	17.2	5.0	0.0	9.6	0.1	0.0	0.3	1.5	0.1	4.6
Batch C1991	0.0	30.4	75.8	0.7	0.0	10.4	1.0	0.0	1.3	0.0	0.9	0.0
Batch C1996	7.8	41.0	2.0	3.0	0.0	1.2	0.8	0.0	0.0	1.0	0.0	2.1
Batch C1998	1.5	0.0	0.0	3.6	6.5	19.9	1.0	33.1	1.0	1.8	1.1	66.7
Batch C2006	0.0	19.0	9.5	2.5	0.0	0.0	2.6	0.0	0.0	12.6	35.4	0.0
Batch C2011	4.0	4.9	2.2	8.4	0.0	0.4	2.0	0.0	0.0	3.9	6.0	9.4
Batch C2013	7.6	0.0	0.0	7.0	0.0	2.1	1.2	0.0	0.0	5.9	0.0	3.1
Batch C2016	NA	0.0	0.0	3.3	NA	0.0	3.8	0.0	0.0	20.4	29.4	12.7
Batch C2044	NA	11.4	7.3	2.1	NA	0.4	0.3	6.7	0.0	4.2	0.7	23.9
Batch C2046	NA	0.0	3.6	1.9	NA	11.5	2.3	0.0	6.2	0.0	47.4	1.6
Batch C2097	NA	0.0	8.5	11.8	NA	50.3	7.1	0.0	0.0	0.0	18.1	0.0

NA - Not Applicable

TABLE 3-3 (Cont.): WATER DATA PRECISION REQUIREMENTS (RELATIVE PRECENT DIFFERENCE OF LABORATORY DUPLICATE) AND RESULTS

TOTAL METALS		Mg	Mn	Hg	Ni	K	Se	Ag	Na	Tl	V	Zn
Required Precision (%)		20	20	20	20	20	20	20	20	20	20	20
Achieved Precision (%)												
Batch	C1913	1.0	12.1	0.0	0.0	2.2	0.0	52.6	2.3	0.0	0.0	0.0
Batch	C1914	1.1	17.1	0.0	0.0	1.3	0.0	66.7	2.8	0.0	0.0	0.0
Batch	C1957	0.6	0.0	0.0	0.0	NA	NA	0.0	NA	NA	NA	0.0
Batch	C1959	0.0	0.3	0.0	8.2	0.9	0.0	4.3	0.8	1.7	4.5	0.3
Batch	C1959	0.0	0.3	0.0	8.2	0.9	0.0	4.3	0.8	1.7	4.5	0.3
Batch	C1961	1.4	0.3	0.0	6.5	3.1	0.0	1.5	2.5	1.7	8.7	0.1
Batch	C1970	0.9	28.4	0.0	0.0	NA	NA	131.1	NA	NA	NA	8.7
Batch	C1971	1.3	2.5	11.8	0.0	NA	NA	0.0	NA	NA	NA	29.6
Batch	C1975	2.7	5.0	0.0	0.0	NA	NA	4.7	NA	NA	NA	4.9
Batch	C1976	2.6	2.9	11.8	0.0	1.8	0.0	72.7	1.8	5.5	0.0	2.3
Batch	C1980	0.7	1.2	0.0	0.0	2.8	0.0	23.3	0.3	2.7	0.0	0.9
Batch	C1987	0.5	0.4	0.0	12.7	2.9	10.5	27.2	2.7	19.6	0.0	0.5
Batch	C1991	0.6	1.1	0.0	0.0	0.9	0.0	39.7	0.4	2.3	0.0	1.1
Batch	C1996	1.3	1.3	0.0	0.0	1.0	0.0	35.4	0.7	6.5	0.0	1.3
Batch	C1998	2.0	1.0	0.0	22.4	4.4	70.6	6.2	3.6	0.0	0.0	2.1
Batch	C2006	2.1	11.4	0.0	0.0	2.0	0.0	0.0	2.5	1.3	0.0	0.0
Batch	C2011	1.7	3.3	7.9	0.0	0.6	0.0	65.5	0.7	24.1	0.0	1.8
Batch	C2013	1.0	0.5	0.0	0.0	0.4	0.0	0.0	1.0	0.0	0.0	3.2
Batch	C2016	3.7	27.8	40.6	0.0	NA	NA	111.4	NA	NA	NA	14.1
Batch	C2044	0.2	1.1	2.5	0.0	NA	NA	7.3	NA	NA	NA	0.9
Batch	C2046	0.5	14.5	0.0	0.0	NA	NA	0.0	NA	NA	NA	4.6
Batch	C2097	7.5	51.7	0.0	0.0	NA	NA	0.0	NA	NA	NA	8.0

NA - Not Applicable

TABLE 3-4: SOIL DATA PRECISION REQUIREMENTS (RELATIVE PRECENT DIFFERENCE OF LABORATORY DUPLICATE) AND RESULTS

TOTAL METALS	Al	Sb	As	Ba	Be	Cd	Ca	Cr	Co	Cu	Fe	Pb
Required Precision (%)	35	35	35	35	35	35	35	35	35	35	35	35
Achieved Precision (%)												
Batch C1963	NA	0.2	0.3	1.7	NA	1.4	0.7	0.4	0.8	1.3	0.9	3.9
Batch C1964	NA	1.0	6.8	2.2	NA	1.8	3.8	1.4	2.1	3.0	3.2	5.1
Batch C1981	NA	1.9	8.9	4.9	NA	3.2	5.4	1.9	3.7	5.8	3.7	5.1
Batch C1982	NA	2.5	10.8	6.7	NA	3.7	7.8	5.5	6.7	6.1	6.1	10.5
Batch C1986	NA	6.3	11.4	9.8	NA	5.3	9.7	9.8	8.7	9.5	6.9	10.9
Batch C1994	NA	10.0	14.5	13.1	NA	9.6	10.6	11.0	9.8	11.6	9.7	11.3
Batch C1995	NA	11.6	16.5	15.2	NA	9.7	10.9	11.5	11.5	15.4	9.7	13.2
Batch C2030	NA	11.8	24.2	15.7	NA	12.2	12.4	16.5	11.5	19.7	13.8	17.9
Batch C2031	NA	14.3	29.8	19.1	NA	14.3	17.3	16.6	12.4	26.7	14.6	20.8
Batch C2034	NA	14.6	45.0	23.2	NA	16.3	18.1	17.4	19.2	26.9	21.7	22.2
Batch C2035	NA	17.4	47.4	24.4	NA	21.0	20.5	17.8	21.1	28.2	21.8	26.1
Batch C2071	4.6	18.2	60.9	32.3	0.0	41.6	25.5	36.0	24.1	37.8	24.1	26.1
Batch C2096	7.9	36.5	69.5	32.9	2.3	44.5	25.7	46.6	28.9	53.3	24.2	51.8
Batch C2118	12.5	52.5	70.1	36.1	12.3	69.6	33.0	47.6	29.6	83.3	30.3	72.6
Batch C2119	18.6	82.1	77.4	45.3	31.8	70.9	65.1	54.3	46.2	163.4	50.2	105.9

NA - Not Applicable

TABLE 3-4 (Cont.): SOIL DATA PRECISION REQUIREMENTS (RELATIVE PRECENT DIFFERENCE OF LABORATORY DUPLICATE) AND RESULTS

TOTAL METALS	Mg	Mn	Hg	Ni	K	Se	Ag	Na	Tl	V	Zn
Required Precision (%)	35	35	35	35	35	35	35	35	35	35	35
Achieved Precision (%)											
Batch C1963	1.1	1.0	0.0	1.0	NA	NA	0.2	NA	NA	NA	1.1
Batch C1964	5.4	2.8	0.0	1.0	NA	NA	0.5	NA	NA	NA	1.1
Batch C1981	7.4	6.9	0.0	2.0	NA	NA	8.1	NA	NA	NA	6.8
Batch C1982	8.4	7.4	0.0	5.5	NA	NA	9.8	NA	NA	NA	7.0
Batch C1986	9.8	9.9	0.2	10.0	NA	NA	10.2	NA	NA	NA	7.6
Batch C1994	14.8	12.1	5.4	10.0	NA	NA	10.9	NA	NA	NA	9.2
Batch C1995	16.3	12.8	10.1	11.8	NA	NA	12.4	NA	NA	NA	13.4
Batch C2030	19.2	12.9	10.3	12.4	NA	NA	12.5	NA	NA	NA	13.5
Batch C2031	20.7	15.4	17.5	14.6	NA	NA	19.4	NA	NA	NA	13.7
Batch C2034	23.7	19.0	18.4	14.6	NA	NA	35.3	NA	NA	NA	18.9
Batch C2035	24.0	20.0	20.9	17.3	NA	NA	46.4	NA	NA	NA	29.1
Batch C2071	32.8	38.4	25.0	20.0	4.0	1.0	50.7	1.1	1.0	2.2	33.5
Batch C2096	45.3	42.8	43.8	24.5	4.1	2.0	67.8	2.5	2.0	7.2	44.7
Batch C2118	49.3	54.9	47.3	31.7	9.5	11.9	82.7	6.2	11.9	10.0	61.9
Batch C2119	64.5	91.9	57.2	46.3	18.2	31.7	110.0	6.3	31.7	14.6	65.2

NA - Not Applicable

3.2 ACCURACY

Accuracy is defined as the ability of the analytical procedure to determine the known quantity of a particular substance in a sample. The standard deviation (SD) of the laboratory matrix spike (MS) was used to generate the overall accuracy statement for the water and soil matrices. The statistical methods used to calculate accuracy were outlined in the Final QAPjP (MDEQ/AMRB-Pioneer, 1994a) for the 1995 Abandoned Mines Hazardous Materials Inventory and are included in Appendix A of this report. Data acceptance or rejection was based upon the percent recovery (%R) of the MS. However, in accordance with EPA guidelines, those recoveries where the concentration of the analyte in the unspiked sample exceeded the spiking concentration by greater than four times (4X) were not used for the accuracy evaluation.

Tables 3-5 and 3-6 present accuracy statements for the water and soil matrices, respectively. Accuracy was reported as a percent range of uncertainty; the laboratory matrix spike results were used to evaluate the overall accuracy reported in the tables. The tables also include the confidence interval with which calculations were based and the overall completeness of the data (completeness is the measure of the number of MS recoveries not evaluated as outliers compared to the total number of MS recoveries reported). The accuracy statements are interpreted as follows: the data lie within the percent range of uncertainty, plus or minus the percent precision of the indicated value. Table 3-7 presents the percent recoveries calculated for each analyte for the water matrix, for each sample batch. Table 3-8 presents the percent recoveries calculated for each analyte for the solid matrix, for each sample batch. Laboratory control standards (LCS) and/or matrix spike samples were not used in the XRF analyses; therefore, XRF accuracy can only be indirectly quantified by comparing the XRF data to laboratory data that used LCS and matrix spike as part of QA/QC. LCS data are notoriously unreliable for XRF instruments and are not recommended by the manufacturer of the LCS.

3.3 REPRESENTATIVENESS

The objective in addressing representativeness is to assess whether the information obtained during the investigations accurately represents the site conditions. Field duplicates, laboratory blanks, and field blanks were used to assess representativeness.

3.3.1 Field Duplicates

Field duplicates consisted of laboratory and XRF analyses. One duplicate pair was submitted to the laboratory for analysis during the investigation. According to the overall number of primary groundwater samples collected (16, including adit discharges), a minimum of one field duplicate pair should have been submitted to the laboratory for analysis. Groundwater was the only sample matrix in which samples were split and analyzed as field duplicates by the laboratory because groundwater was

TABLE 3-5: ACCURACY STATEMENT FOR WATER DATA USING THE MATRIX SPIKE

ANALYTE	CONFIDENCE INTERVAL	COMPLETENESS/NUMBER OF OUTLIERS		RANGE OF UNCERTAINTY (PERCENT)	
		Total Metals	Dissolved Metals	Total Metals	Dissolved Metals
Aluminum	90%	100%/NONE	100%/NONE	4.31	2.51
Antimony	90%	100%/NONE	100%/NONE	7.27	0.58
Arsenic	90%	70%/ONE	78%/ONE	72.8	58.28
Barium	90%	100%/NONE	100%/NONE	6.16	2.00
Beryllium	90%	100%/NONE	100%/NONE	2.68	1.35
Cadmium	90%	100%/NONE	100%/NONE	12.78	22.57
Chromium	90%	100%/NONE	100%/NONE	1.54	1.41
Cobalt	90%	100%/NONE	100%/NONE	1.41	2.09
Copper	90%	100%/NONE	100%/NONE	1.04	1.69
Iron	90%	100%/NONE	100%/NONE	2.94	4.98
Lead	90%	100%/NONE	100%/NONE	52.32	10.85
Manganese	90%	100%/NONE	100%/NONE	3.86	3.82
Mercury	90%	100%/NONE	100%/NONE	2.74	1.81
Nickel	90%	100%/NONE	100%/NONE	1.39	2.05
Selenium	90%	100%/NONE	100%/NONE	9.42	12.1
Silver	90%	100%/NONE	100%/NONE	5.63	5.56
Thallium	90%	100%/NONE	100%/NONE	4.64	12.84
Vanadium	90%	100%/NONE	100%/NONE	1.87	0.54
Zinc	90%	100%/NONE	100%/NONE	3.65	16.23

A 10% risk of false rejection was used to assess outliers

TABLE 3-6: ACCURACY STATEMENT FOR SOIL DATA USING THE MATRIX SPIKE

ANALYTE	CONFIDENCE INTERVAL	COMPLETENESS/NUMBER OF OUTLIERS	RANGE OF UNCERTAINTY (PERCENT)
Aluminum	90%	N A	NA
Antimony	90%	100%/ NONE	9.31
Arsenic	90%	92%/ ONE	18.61
Barium	90%	100%/ NONE	11.13
Beryllium	90%	100%/ NONE	6.28
Cadmium	90%	93%/ ONE	16.94
Calcium	90%	100%/ NONE	NA
Chromium	90%	93%/ ONE	5.19
Cobalt	90%	100%/ NONE	2.49
Copper	90%	93%/ ONE	15.53
Iron	90%	100%/ NONE	NA
Lead	90%	100%/ NONE	48.6
Magnesium	90%	100%/ NONE	NA
Manganese	90%	83%/ ONE	113.3
Mercury	90%	93%/ ONE	13.05
Nickel	90%	100%/ NONE	2.76
Potassium	90%	100%/ NONE	NA
Selenium	90%	100%/ NONE	6.08
Silver	90%	93%/ ONE	42.69
Sodium	90%	100%/ NONE	NA
Thallium	90%	100%/ NONE	6.33
Vanadium	90%	100%/ NONE	7.36
Zinc	90%	87%/ ONE	11.01

A 10% risk of false rejection was used to assess outliers
NA - Not Applicable

TABLE 3-7: WATER DATA ACCURACY REQUIREMENTS (% RECOVERY OF MATRIX SPIKE) AND RESULTS

TOTAL METALS	Al	Sb	As	Ba	Be	Cd	Ca	Cr	Cd	Cu	Fe	Pb
Required Accuracy (%)	75-100	75-100	75-100	75-100	75-100	75-100	75-100	75-100	75-100	75-100	75-100	75-100
Achieved Accuracy (%)												
Batch C1913	97.7	87.6	91.7	102.5	101.3	88.3	NA	97.8	101.5	100.5	99.0	94.4
Batch C1914	99.5	84.4	101.0	102.8	99.5	83.3	NA	95.5	100.0	100.3	101.1	100.3
Batch C1957	96.5	83.5	86.8	100.6	NA	91.7	NA	98.8	99.6	99.6	97.8	81.4
Batch C1959	112.4	99.9	NA	100.5	101.5	53.0	NA	96.7	97.2	NA	NA	-12.5
Batch C1961	109.6	71.1	178.0	99.1	97.5	99.6	NA	95.3	98.3	NA	75.6	95.1
Batch C1970	NA	105.3	104.2	98.2	NA	96.6	NA	92.8	97.8	96.6	98.1	338.3
Batch C1971	NA	100.0	97.7	96.3	NA	81.2	NA	90.9	92.7	94.7	96.0	96.6
Batch C1975	NA	101.2	85.3	99.0	NA	NA	NA	93.4	99.8	97.1	92.0	43.5
Batch C1976	93.2	77.1	336.3	95.8	92.1	92.5	NA	91.8	95.6	94.5	85.5	260.0
Batch C1980	97.4	89.0	392.3	99.9	102.4	-8.8	NA	97.4	98.4	97.5	96.8	93.6
Batch C1987	98.8	101.2	59.0	60.1	100.6	33.5	NA	98.4	94.0	97.3	NA	93.9
Batch C1991	98.3	99.2	NA	100.6	98.9	NA	NA	96.6	98.3	99.0	100.6	90.0
Batch C1996	96.5	79.2	-220.0	99.8	97.5	NA	NA	95.3	99.1	97.6	98.7	170.0
Batch C1998	104.9	95.7	92.1	94.4	95.9	91.5	NA	98.2	94.9	98.8	106.0	103.8
Batch C2006	96.4	97.8	98.0	101.1	99.0	95.2	NA	95.4	99.7	100.7	96.0	103.9
Batch C2011	95.1	89.2	88.5	98.1	99.5	60.4	NA	95.5	98.4	96.8	98.3	72.1
Batch C2013	99.4	88.2	105.1	102.3	98.6	96.7	NA	96.0	101.0	101.0	101.2	110.3
Batch C2016	NA	78.0	100.3	97.2	NA	102.5	NA	91.4	94.0	96.1	92.1	94.1
Batch C2044	NA	58.4	95.5	98.9	NA	100.8	NA	97.4	96.0	96.9	NA	35.1
Batch C2046	NA	85.5	94.5	98.7	NA	88.7	NA	94.7	96.0	97.4	97.2	109.8
Batch C2097	NA	48.2	88.4	90.9	NA	89.1	NA	88.9	88.0	91.5	108.4	79.9

NA - Not Applicable

TABLE 3-7 (Cont.): WATER DATA ACCURACY REQUIREMENTS (% RECOVERY OF MATRIX SPIKE) AND RESULTS

TOTAL METALS	Mg	Mn	Hg	Ni	K	Se	Ag	Na	Tl	V	Zn
Required Accuracy (%)	75-100	75-100	75-100	75-100	75-100	75-100	75-100	75-100	75-100	75-100	75-100
Achieved Accuracy (%)											
Batch C1913	NA	98.6	95.6	99.7	NA	101.8	107.1	NA	99.8	98.4	99.8
Batch C1914	NA	101.1	100.2	102.1	NA	101.8	105.0	NA	94.4	98.8	99.6
Batch C1957	NA	99.4	97.0	100.7	NA	NA	100.6	NA	NA	NA	100.9
Batch C1959	NA	NA	106.1	101.8	NA	116.1	83.8	NA	87.7	97.3	NA
Batch C1961	NA	93.1	105.8	96.6	NA	99.0	74.7	NA	82.4	98.3	101.4
Batch C1970	NA	96.3	95.5	97.4	NA	NA	92.9	NA	NA	NA	99.1
Batch C1971	NA	94.0	94.4	96.0	NA	NA	97.8	NA	NA	NA	96.2
Batch C1975	NA	77.4	100.2	99.7	NA	NA	91.9	NA	NA	NA	6.2
Batch C1976	NA	84.8	94.4	94.7	NA	95.8	105.6	NA	95.8	93.9	80.1
Batch C1980	NA	95.0	102.4	100.7	NA	92.2	91.5	NA	95.4	97.9	94.6
Batch C1987	NA	NA	99.8	94.0	NA	119.3	67.9	NA	93.8	92.6	NA
Batch C1991	NA	95.9	102.6	97.3	NA	94.0	84.4	NA	96.9	97.6	96.0
Batch C1996	NA	110.0	106.4	100.5	NA	126.9	92.5	NA	84.9	98.1	93.8
Batch C1998	NA	99.7	99.0	96.9	NA	88.1	80.3	NA	102.0	97.3	102.9
Batch C2006	NA	98.2	101.0	99.1	NA	104.4	95.3	NA	102.6	98.7	101.9
Batch C2011	NA	97.2	90.7	99.2	NA	124.3	97.7	NA	99.7	98.0	97.9
Batch C2013	NA	100.1	101.0	98.0	NA	141.2	105.1	NA	48.8	99.6	96.4
Batch C2016	NA	93.6	93.7	95.7	NA	NA	94.2	NA	NA	NA	95.4
Batch C2044	NA	98.0	103.2	99.4	NA	NA	95.3	NA	NA	NA	97.8
Batch C2046	NA	98.9	101.8	97.9	NA	NA	98.1	NA	NA	NA	98.8
Batch C2097	NA	99.0	110.2	88.3	NA	NA	98.2	NA	NA	NA	100.6

NA - Not Applicable

TABLE 3-8: SOIL DATA ACCURACY REQUIREMENTS (% RECOVERY OF MATRIX SPIKE) AND RESULTS

TOTAL METALS	Al	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb
Required Accuracy (%)	75-100	75-100	75-100	75-100	75-100	75-100	75-100	75-100	75-100	75-100
Achieved Accuracy (%)										
Batch C1963	NA	48.7	79.9	98.2	NA	110.8	84.9	99.9	74.8	17.6
Batch C1964	NA	52.9	93.3	124.9	NA	119.5	110.1	102.1	90.1	NA
Batch C1981	NA	43.4	84.1	94.1	NA	100.1	82.5	91.8	104.8	NA
Batch C1982	NA	44.0	87.0	63.0	NA	171.7	86.5	96.0	138.8	NA
Batch C1986	NA	53.9	71.1	91.3	NA	96.3	87.2	89.2	NA	NA
Batch C1994	NA	27.7	75.7	100.0	91.4	95.3	98.1	98.7	92.7	116.4
Batch C1995	NA	74.4	84.8	39.9	86.9	93.8	87.1	93.5	86.2	84.4
Batch C2030	NA	57.0	98.3	110.0	NA	96.7	105.8	106.1	70.7	13.9
Batch C2031	NA	26.1	210.3	123.3	NA	105.6	102.9	101.2	122.1	184.9
Batch C2034	NA	52.3	72.7	98.6	94.5	96.1	98.7	103.3	85.7	NA
Batch C2035	-61.9	41.4	80.8	75.2	80.3	95.1	82.8	85.6	91.3	NA
Batch C2071	NA	79.2	NA	43.8	NA	89.4	97.0	99.2	48.4	NA
Batch C2096	NA	111.4	NA	95.4	NA	167.2	63.0	97.5	177.7	NA
Batch C2118	NA	63.5	93.7	108.0	NA	104.8	100.2	103.5	104.1	105.1
Batch C2119	NA	54.9	NA	98.2	NA	222.7	90.8	98.7	NA	NA

NA - Not Applicable

TABLE 3-8 (Cont.): SOIL DATA ACCURACY REQUIREMENTS (% RECOVERY OF MATRIX SPIKE) AND RESULTS

TOTAL METALS	Mn	Hg	Ni	Se	Ag	Tl	V	Zn
Required Accuracy (%)	75-100	75-100	75-100	75-100	75-100	75-100	75-100	75-100
Achieved Accuracy (%)								
Batch C1963	NA	91.6	98.4	NA	79.9	NA	NA	74.5
Batch C1964	NA	85.8	98.8	NA	103.7	NA	NA	NA
Batch C1981	NA	91.6	90.5	NA	96.6	NA	NA	NA
Batch C1982	96.6	91.6	93.2	NA	112.2	NA	NA	NA
Batch C1986	NA	91.6	88.3	NA	101.7	NA	NA	NA
Batch C1994	NA	99.0	95.9	89.5	95.4	92.2	95.3	94.2
Batch C1995	NA	NA	90.4	87.2	81.4	92.3	91.0	NA
Batch C2030	NA	63.4	106.8	NA	102.1	NA	NA	78.1
Batch C2031	456.1	84.7	103.4	NA	417.6	NA	NA	123.4
Batch C2034	114.1	99.6	103.8	93.2	92.5	99.2	100.7	80.2
Batch C2035	80.7	8.7	85.7	79.1	52.9	84.0	83.6	72.0
Batch C2071	52.3	53.6	99.4	NA	NA	NA	NA	69.6
Batch C2096	NA	106.4	93.1	NA	225.1	NA	NA	NA
Batch C2118	109.4	97.2	102.4	NA	107.3	NA	NA	88.9
Batch C2119	NA	32.2	100.1	NA	58.6	NA	NA	NA

NA - Not Applicable

expected to exhibit less variability than the other sample media (e.g., soil, surface water, etc.). The duplicates were submitted blind to the laboratory (the duplicate samples were not identified as such to the laboratory). Table 3-9 presents the evaluation of each field duplicate analyte.

XRF duplicate data (samples analyzed twice in the field) were compared to CLP-specified control limits for precision; the results are presented in Table 3-10 and Table 3-11. Table 3-10 and Table 3-11 are for comparison purposes only, duplicate data outside the ± 35% relative percent difference (RPD) control limit is not a validation criterion for XRF data. The purpose of this comparison is to illustrate the excellent precision attained by the XRF for most analytes. Table 3-10 is based on 13 XRF sample duplicate pairs, while Table 3-11 is based on 19 XRF analytical duplicate pairs analyzed in the field. A sample duplicate pair consists of two individual samples obtained from the same sediment or same composite sample, while an analytical duplicate pair consists of an individual sample analyzed twice.

3.3.2 Field XRF/Laboratory Analyses Comparison

A total of 126 XRF/Laboratory splits were analyzed during the investigations. Table 3-12 presents the overall precision calculated for each analyte when XRF data were compared to corresponding laboratory data. The precision results presented on Table 3-12 are based on the entire data set.

The methods of analysis and associated detection limits vary significantly between the XRF and laboratory analytical methods. The XRF consistently provided higher detection limits than the laboratory for each analyte; additionally, the XRF detection limits for each analyte varied measurably from sample to sample. Consequently, an XRF practical quantitation limit (PQL) was determined for each analyte to provide a basis for comparison of low-range concentrations. The PQL represents the average detection limit provided by the XRF for each analyte. If the concentration reported by the laboratory was lower than the XRF PQL for the corresponding split sample, the RSD was evaluated as zero. To illustrate, if the laboratory provided a concentration of 15 mg/Kg for a specific analyte, and the XRF analytical result provided a corresponding concentration of <50 mg/Kg (less than the detection limit or PQL), the RSD was zero because both concentrations were less than 50 mg/Kg. If both reported concentrations were above the PQL, then the RSD was calculated as usual.

Several statistical methods are available to test the correlation of one method of analysis compared to another. The method chosen as most appropriate for testing the correlation of XRF data with laboratory CLP data was the Pearson's linear correlation coefficient (r) which uses linear regression methods to indicate the degree to which variables are linearly related. The strength of this linear association is a measure of its predictive accuracy and is expressed as a correlation coefficient. The correlation

TABLE 3-9: FIELD DUPLICATE EVALUATION

Total Metals		Dissolved Metals	
ANALYTE	**RPD**	**ANALYTE**	**RPD**
Antimony	1.53	Antimony	17.45
Arsenic	11.92	Arsenic	4.68
Barium	3.02	Barium	1.38
Cadmium	123.3	Cadmium	16.67
Calcium	1.96	Calcium	0.8
Chromium	0	Chromium	0
Cobalt	0	Cobalt	6.19
Copper	5.34	Copper	0
Iron	9.48	Iron	15.63
Lead	4.32	Lead	0
Magnesium	2.34	Magnesium	0
Manganese	8.57	Manganese	14.7
Mercury	26.75	Mercury	0
Nickel	0	Nickel	0
Potassium	21.81	Silver	0
Selenium	4.23	Zinc	4.23
Silver	1.52		

TABLE 3-10

PERCENTAGE OF XRF SAMPLE DUPLICATE PAIRS OF DATA OUTSIDE CLP-SPECIFIED CONTROL LIMITS FOR PRECISION

Analyte	No. of Sample Dup. Pairs Above Detection Limit	RPD > +/-35%
Antimony	9	20%
Arsenic	11	0%
Barium	13	7.7%
Calcium	13	7.7%
Chromium(HI)	1	0%
Copper	7	14.3%
Iron	13	0%
Lead	12	8.3%
Manganese	7	14.3%
Mercury	2	0%
Molybdenum	5	0%
Potassium	13	0%
Rubidium	13	7.7%
Silver	4	0%
Strontium	13	7.7%
Thorium	8	25%
Titanium	12	0%
Uranium	1	0%
Zinc	12	0%
Zirconium	13	0%

TABLE 3-11

PERCENTAGE OF XRF ANALYTICAL DUPLICATE PAIRS OF DATA OUTSIDE CLP-SPECIFIED CONTROL LIMITS FOR PRECISION

Analyte	No. of Analytical Dup. Pairs Above Detection Limit	RPD > +/-35%
Antimony	9	0%
Arsenic	14	21.4%
Barium	19	5.3%
Cadmium	2	50%
Calcium	19	5.3%
Chromium(HI)	1	100%
Chromium(LO)	1	100%
Cobalt	8	12.5%
Copper	13	5.4%
Iron	19	0%
Lead	19	0%
Manganese	8	0%
Mercury	3	0%
Molybdenum	10	0%
Potassium	19	15.8%
Rubidium	19	5.3%
Selenium	2	50%
Silver	12	8.3%
Strontium	18	5.6%
Thorium	13	7.7%
Tin	2	0%
Titanium	16	12.5%
Uranium	4	0%
Zinc	18	5.6%
Zirconium	19	5.3%

TABLE 3-12: OVERALL PRECISION AND CORRELATION OF XRF DATA COMPARED TO LABORATORY DATA (FIELD SPLITS ANALYZED BY BOTH METHODS)

ANALYTE	CONFIDENCE INTERVAL	PERCENT PRECISION	CORELATION COEFFICIENT ALL PAIRS n	r
Arsenic	90%	+/- 7.94	37	0.935
Silver	90%	+/- 27.58	37	0.493
Barium	90%	+/- 33.84	37	0.556
Calcium	90%	+/- 28.64	37	0.920
Cadmium	90%	+/- 8.12	37	0.964
Cobalt	90%	+/- 34.92	37	0.556
Chromium	90%	+/- 19.38	37	0.818
Copper	90%	+/- 7.68	37	0.910
Iron	90%	+/- 11.52	37	0.795
Mercury	90%	+/- 10.87	37	0.959
Manganese	90%	+/- 15.49	37	0.986
Nickel	90%	NA	NA	NA
Lead	90%	+/- 9.43	37	0.918
Strontium	90%	+/- 19.58	37	0.748
Zinc	90%	+/- 11.16	37	0.919

NA - all XRF values were below the detection limit coefficients generated using this analysis can range from -1.0 (perfect inverse linear relationship) to +1.0 (perfect positive linear relationship); a coefficient close to zero indicates that little or no linear relationship exists between the variables being evaluated.

3.3.3 Laboratory Blanks

Laboratory blanks (as they pertained to data validation procedures) were discussed in Section 2.0 of this report. Laboratory contamination problems were very minor. No contaminants were detected above the CRDL in water preparation blank samples; and only one analyte (arsenic) was detected above the CRDL in one soil preparation blank sample. Evaluation of the laboratory blank data indicates that the quality and representativeness of the data were not compromised by laboratory contamination.

3.3.4 Field Blanks

A total of three field blank samples were collected for laboratory analysis during the investigations. According to the overall number of primary groundwater samples collected (60), a minimum of three field blanks should have been submitted to the laboratory for analysis. The blank samples were collecting using de-ionized water placed in the standard sample containers while in the field, and preserved as an actual sample; the blank samples were submitted blind to the laboratory (the samples were not identified as field blanks). Field blanks were used to assess possible sample contamination due to field conditions such as: airborne contaminants entering the sample media during sampling; sample containers becoming contaminated; contaminants introduced due to field sampling procedures or preservatives; etc. Evaluation of the data indicates that no contaminants were detected in the field blank samples at or above the CRDL during the investigation, and contamination problems did not compromise the quality or representativeness of the data.

3.3.5 Summary

In summary, the laboratory preparation blanks and field blank samples indicated that no significant contamination entered the investigation derived samples via laboratory, environmental, preservative, or sample container contamination. Pioneer concludes these quality control data indicate that the analytical results were representative of actual field conditions.

The only method available to address the representativeness of the XRF-generated data was to compare them to the corresponding laboratory data which were determined to be of high quality and representativeness. Comprehensive evaluation of the XRF data determined that the inter-method precision was very good for all of the analytes, and the XRF data showed excellent correlation with the laboratory data for most analytes.

3.4 COMPLETENESS

The objective in addressing completeness is to assess whether enough of the data collected were valid to meet the needs of the investigation. Completeness for each analyte is typically assessed by comparing the number of valid sample batches to the total number of batches analyzed by the laboratory. However, although limitations were applied to some of the laboratory data compiled during this investigation (i.e., flagged data), and a small portion of the data were evaluated as outliers, none of the data were flagged "R" or were otherwise considered unusable. Therefore, 100% of the laboratory data were considered valid for the completeness determination. However, the limitations of the data should be considered when making interpretations.

3.5 COMPARABILITY

The objective in addressing comparability is to assess whether one set of data can be compared to another set of data. Comparability was assessed by determining if EPA-approved analysis methods were used, if the concentration values and units reported were appropriate for the database, if specific sampling locations can be established and documented, and if field collection methods were similar.

The field investigation and laboratory analyses followed QA/QC procedures as outlined in the QAPjP (MDEQ/AMRB-Pioneer, 1994a) and the Sampling and Analysis Plan (SAP; MDEQ/AMRB-Pioneer, 1994c) for all media and all analytical methods. The concentration values and units reported by the laboratory were all appropriate for the database and were generated using standard operating procedures. All sampling locations were documented in field log books and on sample location maps, and all field collection methods followed the SAP and standard operating procedures (MDEQ/AMRB-Pioneer, 1994c). Consequently, the data are considered comparable to the data collected during the 1993 and 1994 Hazardous Materials Inventories.

4.0 SUMMARY AND CONCLUSIONS

The analytical data generated by this investigation were assessed via comprehensive validation and evaluation procedures according to guidelines developed by the EPA, where appropriate. Overall precision, accuracy, representativeness, comparability, and completeness of the data were assessed to determine compliance with the DQOs outlined in the Final QAPjP for the Abandoned Mines Hazardous Materials Inventory (MDEQ/AMRB-Pioneer, 1994a). Although limitations were applied to some of the data, and a small portion of the data were evaluated as outliers, none of the data were flagged "R" or were otherwise considered unusable. Consequently, 100% of the laboratory data compiled during this investigation were considered valid.

Pioneer concludes that the soil and water inorganic data provided by the laboratory meet the DQOs outlined in the QAPjP. CLP SOW analytical methods were utilized which provided analytical support Level IV data. Additionally, comprehensive evaluation of the XRF data determined that the inter-method precision (between XRF data and laboratory data) was very good, and the XRF data showed excellent correlation with the laboratory data. However, the limitations applied to the laboratory and XRF data should be considered when interpreting the data.

5.0 REFERENCES

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APPENDIX A

PROCEDURES FOR CALCULATING ACCURACY AND PRECISION

PROCEDURES FOR CALCULATING ACCURACY

1. Calculate the percent recovery of the lab matrix spike:

$$\% \text{ Recovery of Spike} = \frac{SSR-SR}{SA} \times 100$$

where:

SSR = Spiked Sample Results;
SR = Sample Results; and
SA = Spike Added.

Perfect accuracy would be 100 percent recovery.

2. Calculate the standard deviation of all pairs.

$$SD = \left[\frac{\sum_{i=1}^{n}(Recovery_i - Recovery_{avg.})^2}{n-1}\right]^{1/2}$$

where:

$Recovery_i$ = individual recoveries;
$Recovery_{avg.}$ = average recovery; and
n = number of values.

3. To validate recovery data, the individual recoveries are compared with the average recovery value to identify individual values that lie outside the range of reasonableness. Chauvenet's criterion is used to identify individual recovery values that lie outside the range. To use Chauvenet's criterion, the screening variable is computed for recovery values that are suspected of lying outside the range of reasonableness.

$\text{Screening Variable} = (Recovery_i - Recovery_{avg.}) / SD$.

The calculated screening variable is then compared to the maximum allowable value (found in Table A-1, Chauvenet's Criterion) for the appropriate number of recovery determinations. The suspect recovery value is set aside (set aside values are called outliers) if the calculated screening variable equals or exceeds the maximum allowable value.

TABLE A-1
CHAUVENET'S CRITERION FOR REJECTING A SUSPECTED VALUE[a]

Number of Samples n	Maximum Allowable Values for $(\text{Recovery}_i - \text{Recovery}_{avg.})/SD$[b]
3	1.901
4	1.983
5	2.015
6	2.111
7	2.164
8	2.195
9	2.214
10	2.228
11	2.279
12	2.318
13	2.348
14	2.373
15	2.393
16	2.409
17	2.424
18	2.435
19	2.445
20	2.454
21	2.462
22	2.469
23	2.475
24	2.480
25	2.485
26	2.502
27	2.517
28	2.530
29	2.543
30	2.555
40	2.634

---

[a] Based on t distribution rather than the traditional (normal) distribution.

[b] Individual Recovery = Recovery_i
Average Recovery = $\text{Recovery}_{avg.}$

If outliers are identified using Chauvenet's criterion, a new average recovery and a new standard deviation are recalculated using the remaining good value, and Chauvenet's criterion is reapplied. This procedure is repeated until all surviving recovery values pass Chauvenet's criterion. (Usually one application and one recalculation are enough.) The final average recovery and final standard deviation are calculated from the surviving recovery values. The final average recovery value is used to eliminate any bias from the laboratory data.

4. The range of uncertainty (R) in the recovery is then calculated.

$$\text{þ}R = \text{þ}\ tSD/(n)^{1/2}$$

where:

R = range of uncertainty expressed as a percent;
t = value of the t distribution for the selected confidence level (90 percent) and (n-1) degrees of freedom (Table A-2);
n = number of samples; and
SD = standard deviation.

The range of uncertainty is used in conjunction with the average recovery to determine if bias adjustments are required.

5. The completeness of accuracy data is that percentage of the total number of samples that remained after outliers are identified and set aside with Chauvenet's criterion.

TABLE A-2
DISTRIBUTION OF t

Number of Sample	Degrees of Freedom	90% Complementary Probability
2	1	6.314
3	2	2.920
4	3	2.353
5	4	2.132
6	5	2.015
7	6	1.943
8	7	1.895
9	8	1.860
10	9	1.833
11	10	1.812
12	11	1.796
13	12	1.782
14	13	1.771
15	14	1.761
16	15	1.753
17	16	1.746
18	17	1.740
19	18	1.734
20	19	1.729
21	20	1.725
22	21	1.721
23	22	1.717
24	23	1.714
25	24	1.711
26	25	1.708
27	26	1.706
28	27	1.703
29	28	1.701
30	29	1.699
31	30	1.697
41	40	1.684
61	60	1.671
121	120	1.645

PROCEDURES FOR CALCULATING PRECISION

1. Calculate the relative percent difference (RPD) of each replicate pair:

$$RPD = \frac{|s-D|}{(SD)/2} x 100$$

where:

RPD = relative percent difference;
S = first sample value (original); and
D = second sample value duplicate.

Perfect precision would result in 0 percent RPD.

2. Any RPD value exceeding the control limit of ± 20 percent (water) or ± 35 percent (soil) for inorganics or the control limits in the QAPjP for organics is evaluated as an outlier using the Dixon Q method.

Dixon Test for Outlying Observations

This procedure has an advantage in that an estimate of the standard deviation is not needed to use it. The procedure is:

a. rank the RPD data in order of increasing numerical value;
b. decide which RPD value is suspect (usually the highest number);
c. select the risk for a false rejection (Table A-3); and
d. compute one of the following ratios (statistics):

n	Ratio	If X_n is suspect
$3 \leq n \leq 7$	10	$(X_n - X_{n-1}) / (X_n - X_1)$
$8 \leq n \leq 10$	11	$(X_n - X_{n-1}) / (X_n - X_2)$
$11 \leq n \leq 13$	21	$(X_n - X_{n-2}) / (X_n - X_3)$
$14 \leq n \leq 25$	22	$(X_n - X_{n-2}) / (X_n - X_4)$

e. compare the ratio (statistic) calculated with the values in Table A-3. If the calculated ratio is greater than the tabulated value, rejection may be made with the tabulated risk.

f. Suspected outliers failing the Dixon test are rejected in an iterative process and are not used in the following precision QA statement calculations.

TABLE A-3
VALUES FOR USE IN THE DIXON TEST FOR OUTLIERS

Statistic	Number of Observations,n	10% Risk of False Rejection
t 10	3	.886
	4	.679
	5	.557
	6	.482
	7	.434
t 11	8	.479
	9	.441
	10	.409
t 21	11	.517
	12	.490
	13	.467
t 22	14	.492
	15	.472
	16	.454
	17	.438
	18	.424
	19	.412
	20	.401

Original reference: W.J. Dixon, "Processing Data Outliers," Biometrics, B10MA, 9(No.1): 74-89 (March 1953).

3. Calculate the relative standard deviation (RSD) of each replicate pair.

$$RSD_{each\ pair} = SD\ each\ pair/Mean$$

4. Calculate the RSD for all the pairs.

$$RSD_{overall} = \left[\frac{\sum_{i=1}^{n} (RSD_{each^2})}{n\text{-}1_{pair}} \right]^{1/2}$$

5. Calculate precision as a percent.

$$Precision\ (\%) = \left[\frac{t_{(n-1)}\ x\ RSD_{overall}}{(n-1)^{1/2}} \right] x\ 100$$

Where t is the value from the 90 percent probability level (Table A-2).

6. The completeness of precision data is that percentage of the total number of RPD values that remained after outliers identified and set aside with Dixon's Q ratio.

RAIMSS REPORT

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU

ABANDONED HARDROCK MINE PRIORITY SITES

RECLAIMED ABANDONED AND INACTIVE MINES SCORING SYSTEM (RAIMSS)

Prepared For:

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1.0 INTRODUCTION

This document describes the Reclaimed Abandoned and Inactive Mines Scoring System (RAIMSS) used by the Montana Department of Environmental Quality/Abandoned Mine Reclamation Bureau (MDEQ/AMRB) to rescore abandoned and inactive mining sites that have been reclaimed. The RAIMSS has been developed to provide a mechanism for MDEQ/AMRB to determine whether the reclamation activities performed at a site have satisfactorily mitigated the human health and environmental threats identified at the site. The RAIMSS provides a rationale for proposing that no further reclamation is necessary for a site and the site can be removed from the AMRB's priority list if the RAIMSS score is below a threshold value. The scoring system is very similar to the Abandoned and Inactive Mines Scoring System (AIMSS) developed by the AMRB (MDEQ/AMRB-Pioneer, 1994); however, it has been modified slightly to address reclaimed mine sites.

Standard reclamation goals have been developed by MDEQ/AMRB, based primarily on criteria generated by the U.S. Environmental Protection Agency's (EPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process, for mitigating releases or threatened releases of hazardous substances from abandoned and inactive mines. These goals are based on the relative reduction in risk to public health or the environment, taking into account the populations at risk (human and ecologic), the hazard potential of the substances, the potential for contamination of drinking water supplies, the potential for direct human contact, and the potential for detrimental effects to sensitive ecosystems.

The RAIMSS is not, and is not intended to be, equivalent to a detailed qualitative or quantitative human health or ecologic risk assessment, as might be performed as part of remedial actions. This system is used to score differing and disparate sites using a common basis - relative risks to human health or the environment. The RAIMSS attempts to estimate risks posed by reclaimed mine sites being evaluated relative to other mine sites. Since the scoring is intended as a screening mechanism, the effects of potential inaccuracies have been minimized by intervalizing those data with the greatest degree of uncertainty (e.g., population and waste quantities). It also maximizes the use of existing site data, especially the measured concentrations and volumes present in waste materials with respect to background concentrations.

Most of the evaluation factors and scores are the same as used in the AIMSS; the scoring algorithm is identical. The primary sources of information used to rescore a reclaimed mine site are the reclamation derived site information and laboratory data generated by those investigations. There are two major differences between the RAIMSS and the AIMSS: 1) in the RAIMSS, the observed release and exceedences components have been removed from each pathway, since it is difficult to determine immediate improvements in most of the media evaluated; and 2) an additional (lower score) category for waste source containment (accessibility in direct contact) has been added to the RAIMSS to reflect the additional protection afforded by a combination of several mitigation measures, which together meet the risk reduction goals for the site.

The scoring system's structure (algorithm) is identical to that used by the AIMSS. Four pathways or routes of exposure are evaluated:

1) groundwater pathway;

2) surface water pathway;

3) air pathway; and

4) direct contact pathway.

Within each of the four pathways, three primary factors are evaluated:

1) the likelihood of release of hazardous constituents to the pathway;

2) waste characteristics, including the concentrations of hazardous constituents corrected for background, the quantity of wastes (volumes, areas), and the relative toxicity of each constituent to humans and ecosystems; and

3) the potential receptors (targets) of exposure to hazardous constituents at the site, both human and ecologic.

The following is a discussion of each of the pathways, factors, and other site-specific criteria as they relate to the RAIMSS. Several factors are redundant between pathways; these factors will be fully discussed the first time they are identified, and referenced when used subsequently. Again, factors and scores are similar to those used in the AIMSS. Appendix A provides a detailed example of the Brooklyn Mine and Millsite that has been rescored using the RAIMSS after reclamation performed in 1995. Appendix B provides a detailed example of the calculation of the waste characteristics score for each of the sources at the Brooklyn site, post-reclamation. This example is provided to aid in understanding the RAIMSS.

2.0 GROUNDWATER PATHWAY

The groundwater pathway is evaluated using the following factors: the likelihood of release to groundwater; groundwater waste characteristics; and groundwater targets. The product of these three factors is the groundwater pathway score.

2.1 GROUNDWATER LIKELIHOOD OF RELEASE

The likelihood of release factor evaluates the potential to release constituents to groundwater using two criteria: the containment of the wastes at the site and the estimated depth to groundwater.

2.1.1 Containment After Reclamation

Containment is evaluated with respect to engineered reclamation designed to prevent releases from contaminant sources to groundwater, including:

1) amendments to the waste materials that reduce contaminant solubility or mobility;

2) slope reduction/stabilization with a vegetated topsoil cover (12 inches thick) over the waste;

3) surface water run-on diversions and run-off catchments;

4) installation of an impermeable cap system over the waste; and

5) installation of an impermeable liner beneath the waste materials (in-place or at a constructed repository) with a leachate collection system.

These engineered systems (3, 4, and 5) must be intact, functioning, and regularly monitored and maintained.

Using each waste source at the site, assign a value to the source as follows: none of the above containment systems = 20; presence of one of the above systems = 10; presence of two of the above systems = 5; presence of three of the above systems (excluding the impermeable cap and underliner) = 1; presence of four of the above systems (excluding only the underlier) = 0.1; or all five of the above, including an underliner, leachate collection, and a cap system = 0.05.

2.1.2 Depth to Groundwater

The depth to groundwater for each source is estimated using the existing well logs from the area, observation of springs, seeps or flowing adits at the site, and the relative topography of the site (stream valley or hilltop). Using this estimated depth (or actual depth, if available), assign a value for each source as follows: shallow (less than 25 feet to water) = 20; moderate (25 to 100 feet) = 10; or deep (greater than 100 feet) = 2. These values are the same as those used for the detailed (source specific) AIMSS, but will likely be different for different sources, or if additional data are available.

2.1.3 Groundwater Likelihood of Release Score for Reclaimed Site

Calculate the groundwater likelihood of release score by multiplying the containment value by the depth value (Maximum score is 400).

2.2 GROUNDWATER WASTE CHARACTERISTICS

Waste characteristics for the groundwater pathway are evaluated using the volume of waste materials (sources) at the site, the concentrations of constituents in samples of the waste material, the background concentrations, and the EPA HRS human toxicity value (SCDM, 1994). These values are the same as those used for the AIMSS, but are source specific. If sources have been combined, such as placed in a repository, the waste characteristics scores for each of those sources are summed.

2.2.1 Quantity

A quantity value is assigned according to measured volumes of waste materials in cubic yards (cy) for each solid matrix source(s) or portions of a source, for which analytical data exist. Each sample collected at a site is assigned a volume that the sample represents. This sample volume is derived based on the source volume(s) that the composite sample analyses represents.

Also, a value is assigned for each measured and sampled adit discharge in gallons per day (gpd = cubic feet per second [cfs] X 646,272 gpd/cfs). The conversion of cfs to gpd is used to equate adit discharges (highly mobile constituents) with other solid matrix sources (less mobile) at the site.

Each media (solid or water) and sampled source at the site will be scored separately. Assign the sample quantity value and the toxicity value as follows:

Range (cy or gpd)	Quantity Value
less than 10	0.003
10-30	0.01
30-100	0.03
100-300	0.1
300-1,000	0.3
1,000-3,000	1.
3,000-10,000	3.
10,000-30,000	10.
30,000-100,000	30.
100,000-300,000	100.
300,000-1,000,000	300.
more than 1,000,000	1,000.

Constituent	Human Toxicity Value
Antimony	10.
Arsenic	10.
Barium	10.
Cadmium	10.
Chromium	10.
Cobalt	0.001
Copper	0.
Iron	0.
Lead	10.
Mercury	10.
Nickel	0.1
Silver	0.1
Zinc	0.01
Thorium	10.
Uranium	10.
Cyanide	0.1
Asbestos	10.

2.2.2 Hazard

The hazard value is calculated for each constituent (note: asbestos is not included in the groundwater waste characteristics evaluation since it is immobile in groundwater and in subsurface soils) as the product of the sample concentration (solids in mg/Kg or water in μg/L) and toxicity values (derived from the EPA HRS human toxicity values divided by 1,000; SCDM, 1994). Solid sample concentrations are corrected by subtracting background concentrations, and using the difference in the calculation; adit discharge concentrations are used directly because background concentrations are not applicable. If adit discharges have been treated, use concentration data for the treated discharge.

A separate product is calculated for each element, the element-products are summed for each sample, and the sample values are summed for each source.

For sample #1:
Constituent 1: (Sample conc. - background conc.) x Human toxicity value = _______
Constituent 2: (Sample conc. - background conc.) x Human toxicity value = _______
.
.
Constituent n: (Sample conc. - background conc.) x Human toxicity value = _______

The sum of the element-products is the hazard value for sample #1 = _______

The hazard value procedure is repeated for each sample collected at the site.

For sample #n:
Constituent 1: (Sample conc. - background conc.) x Human toxicity value = _______
Constituent n: (Sample conc. - background conc.) x Human toxicity value = _______
Sum of element-products (hazard value) for sample #n = _______

2.2.3 Groundwater Waste Characteristics Score

The waste characteristics score is calculated by multiplying the sample quantity value and the hazard value (calculated above) for each sample, summing the values for all samples from the source, and then dividing by 10,000:

Sample #1: Sample quantity value x sample #1 hazard value = _______
.
.
Sample #n: Sample quantity value x sample #n hazard value = _______

The groundwater waste characteristics score for each source is the sum of the sample products divided by 10,000.

2.3 GROUNDWATER TARGETS

The groundwater targets score is evaluated by assessing those potential users of groundwater, giving a greater weight to those potential groundwater users that are closer to the site. This method differs slightly from the HRS in that the detailed wells/distance/dilution factoring is simplified reflecting the limited well information available. These values are the same as those used for the detailed (source specific) AIMSS, but will likely be different for different sources, or if additional information is available.

2.3.1 Number of Wells Within One Mile

This value is derived using the number of wells within one mile of the site, as reported in the MBMG well inventory database, multiplied by 2.5 persons per well. The assumption of 2.5 persons per well is based on the average number of persons per residence reported for Montana. If site specific information indicates more or fewer wells, use that value if it can be documented.

2.3.2 Number of Wells Between One and Four Miles

This value is derived using the number of wells within four miles of the site, as reported in the MBMG well inventory database, and subtracting the number of wells within one mile (above). These targets are also multiplied by 2.5 persons per well, and then divided by a distance/dilution factor of 2.5, to reflect the lessened risk due to greater distance from the sources and dilution. If site specific information indicates more or fewer wells, use that value if it can be documented.

2.3.3 Distance to Nearest Well

This value is an adjustment used to emphasize the greater risk to wells close to the site (per HRS). Only the nearest well is used (residential or recreational use), regardless of the number or frequency of persons using that well. Assign a value as follows: less than 1,000 feet = 10; between 1,000 feet and 1/2 mile = 5; and more than 1/2 mile = 0.

2.3.4 Groundwater Targets Score

The groundwater targets score is the sum of the above three values: wells within one mile, wells between one and four miles, and the nearest well value.

2.4 GROUNDWATER PATHWAY SCORE

The Groundwater Pathway Score is the product of the Groundwater Likelihood of Release Score (Section 2.1), the Groundwater Waste Characteristics Score (Section 2.2), and the Groundwater Targets Score (Section 2.3).

3.0 SURFACE WATER PATHWAY

The surface water pathway is evaluated using the following factors: the likelihood of release to surface water, surface water waste characteristics, and surface water targets. The product of these three factors is the surface water pathway score.

3.1 SURFACE WATER LIKELIHOOD OF RELEASE

The likelihood of release factor evaluates the potential to release constituents to surface water using two criteria: the containment of the wastes at the site and the distance from waste materials to surface water.

3.1.1 Containment After Reclamation

Containment is evaluated with respect to engineered reclamation designed to prevent releases from contaminant sources to surface water via flooding and run-off, including:

1) waste containment dams with erosion protection and surface water diversions designed to withstand the 100-year flood event or complete removal of wastes from the 100-year floodplain;

2) effective and functioning run-on/run-off control systems;

3) sediment collection basins;

4) waste slope reduction and stabilization with a vegetated topsoil cover with erosion control mats if required (slopes greater than 2.5:1); and

5) Treatment and/or diversion of discharging adits (if any) such that:

   a) flow is diverted around other wastes and does not discharge to a surface water body, or

   b) flow is treated before discharging to surface water.

These engineered systems must be intact, functioning, and regularly monitored and maintained.

Using each waste source at the site, assign a value to the source as follows: none of the above containment systems = 20; presence of one of the above systems = 10; presence of two of the above systems = 1; presence of three of the above systems = 0.1; or presence of four of the above five systems = 0.05.

3.1.2 Distance to Surface Water

The distance from the source material to the nearest surface water drainage (including intermittent drainages) is used for this factor. Use this distance to assign a value as follows: less than 25 feet = 20; between 25 and 100 feet = 10; and greater than 100 feet = 2.

3.1.3 Surface Water Likelihood of Release Score

Calculate the surface water likelihood of release score by multiplying the containment value by the distance value (Maximum score is 400).

3.2 SURFACE WATER WASTE CHARACTERISTICS

Waste characteristics for the surface water pathway are evaluated using the volume of waste materials at the site, the concentrations of constituents in samples of the waste material, the background concentrations, and the EPA HRS human toxicity and ecotoxicity values (SCDM, 1994). These values are the same as those used for the AIMSS, but are source specific. If sources have been combined, such as placed in a repository, the waste characteristics scores for those sources are summed.

3.2.1 Quantity

A quantity value is assigned in the same manner as the groundwater pathway (Section 2.2.1). A value is also assigned for adit discharges as in the groundwater pathway.

Each media (solid or water) and sampled source at the site will be scored separately. Assign the sample quantity value, the toxicity value, and the ecotoxicity value as follows:

Range (cy or gpd)	Quantity Value
less than 10	0.003
10-30	0.01
30-100	0.03
100-300	0.1
300-1,000	0.3
1,000-3,000	1.
3,000-10,000	3.
10,000-30,000	10.
30,000-100,000	30.
100,000-300,000	100.
300,000-1,000,000	300.
more than 1,000,000	1,000.

Constituent	Human Toxicity Value	Ecotoxicity Value
Antimony	10.	0.
Arsenic	10.	0.01
Barium	10.	0.001
Cadmium	10.	1.
Chromium	10.	10.
Cobalt	0.001	0.
Copper	0.	0.1
Iron	0.	0.01
Lead	10.	1.
Mercury	10.	10.
Nickel	0.1	0.01
Silver	0.1	10.
Zinc	0.01	0.01
Thorium	10.	10.
Uranium	10.	10.
Cyanide	0.1	1.
Asbestos	10.	0.

3.2.2 Human Hazard

The human hazard value is calculated for each constituent (note: manganese is excluded, asbestos is included) as the product of the sample concentration (corrected by subtracting background, solids in mg/Kg or water in μg/L) and human toxicity values (derived from the EPA HRS human toxicity values/1,000; SCDM. 1994). If adit discharges have been treated, use concentration data for the treated discharge. A separate product is calculated for each element, the element-products are summed for each sample, and the sample values are summed for each source.

For sample #1:
Constituent 1: (Sample conc. - background conc.) x Human toxicity value = ________
Constituent 2: (Sample conc. - background conc.) x Human toxicity value = ________
.
.
Constituent n: (Sample conc. - background conc.) x Human toxicity value = ________

The sum of the element-products is the human hazard value for sample #1 = ________

The human hazard value procedure is repeated for each sample collected at the site.

For sample #n:
Constituent 1: (Sample conc. - background conc.) x Human toxicity value = _______
Constituent n: (Sample conc. - background conc.) x Human toxicity value = _______
Sum of element-products (human hazard value) for sample #n = _______

The waste score (human) is calculated by multiplying the sample quantity value and the human hazard value (calculated above) for each sample, summing the values for all samples from the source, and then dividing by 10,000:

Sample #1: Sample quantity value x sample #1 human hazard value = ________

.

.

Sample #n: Sample quantity value x sample #n human hazard value = ________

The waste score (human) for each source is the sum of the sample products divided by 10,000.

3.2.3 Ecologic Hazard

The ecologic value is calculated for each constituent (note: manganese is excluded) as the product of the sample concentration (corrected by subtracting background, solids in mg/Kg or water in μg/L) and ecotoxicity values (derived from the EPA HRS ecotoxicity values/1,000; SCDM, 1994, see table in Section 3.2.1). If adit discharges have been treated, use concentration data for the treated discharge. A separate product is calculated for each element and the element-products are summed for each sample.

For sample #1:
Constituent 1: (Sample conc. - background conc.) x ecotoxicity value = _______
Constituent 2: (Sample conc. - background conc.) x ecotoxicity value = _______

.

.

Constituent n: (Sample conc. - background conc.) x ecotoxicity value = _______

The sum of element-products is the ecohazard value for sample #1 = _______

The ecohazard value procedure is repeated for each sample collected at the site.

For sample #n:
Constituent 1: (Sample conc. - background conc.) x ecotoxicity value = _______
Constituent n: (Sample conc. - background conc.) x ecotoxicity value = _______

Sum of element-products (ecohazard value) for sample #n = _______

The waste score (ecologic) is calculated by multiplying the sample quantity value and the ecohazard value (calculated above) for each sample from the source, summing the values for all samples, and then dividing by 10,000:

Sample #1: Sample quantity value x sample #1 ecohazard value = ________

.

.

Sample #n: Sample quantity value x sample #n ecohazard value = ________

The waste score (ecologic) for each source is the sum of the sample products divided by 10,000.

3.2.4 Surface Water Waste Characteristics Score

The total surface water waste characteristics score for each source is the sum the human waste score and the ecologic waste score.

3.3 SURFACE WATER TARGETS

The surface water targets score is evaluated by assessing those potential users of surface water within 15 miles downstream (same as HRS target distance limit), including environmental targets (wetlands, fisheries, etc.). The target scoring differs from the HRS in that it is simplified and includes a target that the HRS does not consider (impacted surface water drainages). These values are the same as those used for the detailed (source specific) AIMSS, but may be different for different sources, or updated information.

3.3.1 Number of Persons Using Surface Water for Drinking Water

The number of persons using surface water for drinking water was compiled from Water Quality Bureau records regarding stream designations for drinking water supplies and inventoried water systems. The total population served was adjusted for dilution of the receiving stream, per the HRS dilution factors. The potentially affected drinking water intakes that were used for sites evaluated by AMRB, and the appropriate dilution factors are listed below.

Water System - Location	Service Population	Flow	Dilution Factor*	Adjusted Population
Helena - Tenmile Creek intake	24,500	17 cfs	0.1	2,450
Butte - Basin Creek / Big Hole R.	33,744	19 cfs	0.1	3,374
Anaconda - Silver Lake pipeline	9,771	21 cfs	0.1	977

* The HRS dilution factor for receiving streams between 10 and 100 cfs = 0.1.

3.3.2 Impacted Drainage(s) Remaining After Reclamation

The distance of impacted stream/drainage downstream from the site with respect to sedimentation and acid mine drainage characteristics was recorded on the inventory form during the site visit. The value assigned is the distance in thousands of feet (observed impacted distance / 1,000). If drainages have been reclaimed or rebuilt, use only the unreclaimed distance.

3.3.3 Other Surface Water Uses

Other surface water resource uses within 15 miles downstream were determined from the site visit, inspection of the Montana Department of Fish, Wildlife and Parks (MDFWP) data base (fisheries, wetlands, threatened and endangered species), U.S. Geological Survey (USGS) topographic maps and U.S. Department of Agriculture/Forest Service (USFS) maps, and the Montana Department of Natural Resources and Conservation (MDNRC) water rights database. Assign these values as follows:

Wetlands (5 acre minimum) observed or in the MDFWP database = 10; otherwise = 0.

Fishery class in the MDFWP database: Class 1 = 20; Class 2 = 10; Class 3 = 5; Class 4 = 1; Class 5, Class 6, or not classified = 0.

Recreational use at downstream parks or recreation areas (maps, observation) = 5; otherwise = 0.

Irrigation/stock watering from the MDNRC database, observed at site, or on maps = 2; else = 0.

Threatened/endangered species habitat from the MDFWP database = 5; otherwise = 0.

3.3.4 Surface Water Targets Score

The surface water targets score is the sum of the above seven values: drinking water use, impacted drainages, wetlands, fishery, recreation use, irrigation/stock watering, and threatened/endangered species habitat.

3.4 SURFACE WATER PATHWAY SCORE

The Surface Water Pathway score is the product of the Surface Water Likelihood of Release Score (Section 3.1), the Surface Water Waste Characteristics Score (Section 3.2), and the Surface Water Targets Score (Section 3.3).

4.0 AIR PATHWAY

The air pathway is evaluated using the following factors: the likelihood of release to the atmosphere, air waste characteristics, and air targets. The product of these three factors is the air pathway score.

4.1 AIR LIKELIHOOD OF RELEASE

The likelihood of release factor evaluates the potential to release constituents to the air pathway using two criteria: the containment of the wastes at the site; and the distance to the nearest population.

4.1.1 Containment After Reclamation

Containment is evaluated with respect to dust emissions (topsoil, vegetative cover, or perennially wetted). Dust propagation potential for each source was evaluated during the initial site visit and recorded on the inventory form as high, moderate, low, or none. The dust potential was derived considering the percent of vegetative or other cover, available fines, topography, and moisture content.

Using the dust propagation potential noted on the form for each unreclaimed source, assign a value to the source as follows: high dust potential = 20; moderate dust potential = 15; low dust potential = 10; or no dust potential (on form) = 1. If the waste source has been reclaimed with at least 12 inches of continuous, uncontaminated cover soil, revegetated, and dust release has been effectively prevented, assign a value of 0.1.

4.1.2 Distance to Nearest Population

The distance from the source material to the nearest population (town) or individual residence is used for this factor. Use this distance to assign a value as follows: less than 1,000 feet = 20; between 1,000 feet and 1/2 mile = 10; and greater than 1/2 mile = 5.

4.1.3 Air Likelihood of Release Score

Calculate the air pathway likelihood of release score by multiplying the containment value by the distance value (Maximum score = 400).

4.2 AIR WASTE CHARACTERISTICS

Waste characteristics for the air pathway are evaluated using the exposed surface area of each source (post-reclamation) at the site, the concentrations of constituents in surficial samples of the waste material, the background concentrations, and the EPA HRS human toxicity and ecotoxicity values (SCDM, 1994).

4.2.1 Quantity

A quantity value is assigned according to measured estimates of exposed surface areas (in 100's of square feet) for each solid matrix source(s) or portions of a source, for which analytical data exist. If a discrete surface sample was collected, only those analyses are used. The surface area is derived based on the source surface area(s) that the sample analyses represents.

Each source at the site is scored separately. Assign the sample quantity value, the toxicity value, and the ecotoxicity value as follows:

Range (100's of sq. ft.)	Quantity Value
less than 10	0.001
10-100	0.01
100-1,000	0.1
1,000-10,000	1.
10,000-100,000	10.
100,000-1,000,000	100.
more than 1,000,000	1,000.

Constituent	Human Toxicity Value	Ecotoxicity Value
Antimony	10.	0.
Arsenic	10.	0.01
Barium	10.	0.001
Cadmium	10.	1.
Chromium	10.	10.
Cobalt	0.001	0.
Copper	0.	0.1
Iron	0.	0.01
Lead	10.	1.
Mercury	10.	10.
Nickel	0.1	0.01
Silver	0.1	10.
Zinc	0.01	0.01
Thorium	10.	10.
Uranium	10.	10.
Cyanide	0.1	1.
Asbestos	10.	0.

4.2.2 Human Hazard

The human hazard value is calculated for each constituent (note: manganese is excluded, asbestos is included) as the product of the sample concentration (in mg/Kg) and human toxicity values (derived from the EPA HRS human toxicity values/1,000; SCDM, 1994). Solid sample concentrations are corrected by subtracting background concentrations, and using the difference in the calculation. A separate product is calculated for each element and the element-products are summed for each sample, and the sample values are summed for each source.

For sample #1:
Constituent 1: (Sample conc. - background conc.) x Human toxicity value = _______
Constituent 2: (Sample conc. - background conc.) x Human toxicity value = _______
.
.
Constituent n: (Sample conc. - background conc.) x Human toxicity value = _______

The sum of the element-products is the human hazard value for sample #1 = _______

The human hazard value procedure is repeated for each sample collected at the site.

For sample #n:
Constituent 1: (Sample conc. - background conc.) x Human toxicity value = _______
Constituent n: (Sample conc. - background conc.) x Human toxicity value = _______
Sum of element-products (human hazard value) for sample #n = _______

The waste score (human) is calculated by multiplying the sample quantity value and the human hazard value (calculated above) for each sample, summing the values for all samples from that source, and then dividing by 10,000:

Sample #1: Sample quantity value x sample #1 human hazard value = ________
.
.
Sample #n: Sample quantity value x sample #n human hazard value = ________

The waste score (human) is the sum of the sample products divided by 10,000.

4.2.3 Ecologic Hazard

The ecologic value is calculated for each constituent (note: manganese is excluded) as the product of the sample concentration (corrected by subtracting background, in mg/Kg) and ecotoxicity values (derived from the EPA HRS ecotoxicity values/1,000; SCDM, 1994, see table in Section 4.2.1). A separate product is calculated for each element and the element-products are summed for each sample.

For sample #1:
Constituent 1: (Sample conc. - background conc.) x ecotoxicity value = _______
Constituent 2: (Sample conc. - background conc.) x ecotoxicity value = _______
.
.
Constituent n: (Sample conc. - background conc.) x ecotoxicity value = _______

The sum of element-products is the ecohazard value for sample #1 = _______

The ecohazard value procedure is repeated for each sample collected from the source.

For sample #n:
Constituent 1: (Sample conc. - background conc.) x ecotoxicity value = _______
Constituent n: (Sample conc. - background conc.) x ecotoxicity value = _______

Sum of element-products (ecohazard value) for sample #n = _______

The waste score (ecologic) is calculated by multiplying the sample quantity value and the ecohazard value (calculated above) for each sample, summing the values for all samples, and then dividing by 10,000:

Sample #1: Sample quantity value x sample #1 ecohazard value = ________

.

.

Sample #n: Sample quantity value x sample #n ecohazard value = ________

The waste score (ecologic) is the sum of the sample products divided by 10,000.

4.2.4 Air Pathway Waste Characteristics Score

The total air pathway waste characteristics score for the source is the sum the human waste score and the ecologic waste score.

4.3 AIR PATHWAY TARGETS

The air pathway targets score is evaluated by assessing population and environmental receptors near the site potentially affected by airborne releases of waste constituents from the site. These values are the same as those used for the detailed (source specific) AIMSS, but may be different for different sources. If site specific information indicates more or receptors, use that value if it can be documented.

4.3.1 Population Within Four Miles

Population within a 4-mile radius of the site was determined from available census information for larger municipalities, and from maps and field observations for smaller municipalities and rural populations. The four-mile distance is the same as the HRS target distance limit for the air pathway. To account for uncertainty in the population figures, population is intervalized into ranges (ranges are from the HRS) and recorded on the site inventory form: 0; 1-10; 10-30; 30-100; 100-300; 300-1,000; 1,000-3,000; 3,000-10,000; and >10,000. The lower value of the range is used to be conservative in assigning a population score. This value is assigned as the population within four miles.

4.3.2 Distance to Nearest Residence

The nearest residence score is an adjustment used to emphasize the greater risk to persons living close to the site (per the HRS). The distance to the nearest residence was observed during the site visit and recorded on the inventory form. Only the nearest residence is used (full-time or recreational use), regardless of the number or frequency of persons living at the residence. Assign a value as follows: less than 1,000 feet = 10; between 1,000 feet and 1/2 mile = 5; and more than 1/2 mile = 0.

4.3.3 Sensitive Environments

Sensitive environments on or near the site (within the 4-mile target distance limit) are assigned air target scores, as in the HRS. Sensitive environments were determined from the site visit and inspection of the MDFWP data base (wetlands, threatened and endangered species). Assign these values as follows:

Wetlands (5 acre minimum) observed or MDFWP database = 10; otherwise =0.

National or State parks or wilderness areas = 10; otherwise = 0.

Threatened/endangered species habitat from the MDFWP database = 5; otherwise = 0.

4.3.4 Air Pathway Targets Score

The air pathway targets score is the sum of the above five values: population within four miles, nearest residence, wetlands, parks/wilderness, and threatened/endangered species habitat.

4.4 AIR PATHWAY SCORE

The Air Pathway Score is the product of the Air Likelihood of Release Score (Section 4.1), the Air Waste Characteristics Score (Section 4.2), and the Air Targets Score (Section 4.3).

5.0 DIRECT CONTACT

The direct contact exposure route is evaluated using the following factors: the likelihood of exposure, direct contact waste characteristics, and direct contact targets. The product of these three factors is the direct contact score.

5.1 DIRECT CONTACT LIKELIHOOD OF EXPOSURE

The direct contact likelihood of exposure factor evaluates the potential for direct contact with constituents at the site using two criteria: the accessibility of the wastes at the site and the distance to the nearest population or residence.

5.1.1 Accessibility After Reclamation

Accessibility of wastes at the site is evaluated with respect to the presence of fences, signs, physical barriers, gates, or guards that restrict access to the site wastes by residents or recreational users. These access restrictions must be intact and at least partially effective at limiting access to waste sources by people.

Each source is assigned a value as follows: easily accessible - no fences, gates, or signs = 20; moderately accessible - barbed wire fences, road gated, and signs posted = 10; difficult access - chain link fence, road gated and locked = 5; and not accessible - site completely fenced, access road gated and locked, site guarded (does not include locked or manned access points more than 1/2 mile from the actual mine site) = 1. If the waste materials at the site have been reclaimed with at least 12 inches of continuous, uncontaminated cover soil, revegetated, and direct contact exposure by visitors and trespassers has been effectively prevented, assign a value of 0.1.

5.1.2 Distance to Nearest Population

The distance from the source material to the nearest population (town) or individual residence is used for this factor. Use this distance to assign a value as follows: less than 1,000 feet = 20; between 1,000 feet and 1/2 mile = 10; and greater than 1/2 mile = 5.

5.1.3 Direct Contact Likelihood of Exposure Score

Calculate the direct contact likelihood of exposure score by multiplying the accessibility value by the distance value (Maximum score = 400).

5.2 DIRECT CONTACT WASTE CHARACTERISTICS

Waste characteristics for direct contact are evaluated using the exposed surface area of each source (post reclamation) at the site, the concentrations of constituents in samples of the waste material, the background concentrations, and the EPA HRS human toxicity value (SCDM, 1994).

5.2.1 Quantity

A quantity value is assigned in the same manner as the air pathway (Section 4.2.1). Each source at the site is scored separately. Assign the sample quantity value and the toxicity value as follows:

Range (100's of sq. ft.)	Quantity Value
less than 10	0.001
10-100	0.01
100-1,000	0.1
1,000-10,000	1.
10,000-100,000	10.
100,000-1,000,000	100.
more than 1,000,000	1,000.

Element	Human Toxicity Value
Antimony	10.
Arsenic	10.
Barium	10.
Cadmium	10.
Chromium	10.
Cobalt	0.001
Copper	0.
Iron	0.
Lead	10.
Mercury	10.
Nickel	0.1
Silver	0.1
Zinc	0.01
Thorium	10.
Uranium	10.
Cyanide	0.1
Asbestos	10.

5.2.2 Hazard

The hazard value is calculated for each constituent (note: manganese is excluded, asbestos is included) as the product of the sample concentration (in mg/Kg, corrected by subtracting background) and human toxicity values (derived from the EPA HRS human toxicity values/1,000; SCDM, 1994). A separate product is calculated for each element, the element-products are summed for each sample, and the sample values are summed for each source.

For sample #1:
Constituent 1: (Sample conc. - background conc.) x Human toxicity value = _______
Constituent 2: (Sample conc. - background conc.) x Human toxicity value = _______
.
.
Constituent n: (Sample conc. - background conc.) x Human toxicity value = _______

The sum of the element-products is the hazard value for sample #1 = _______

The hazard value procedure is repeated for each sample collected at the site.

For sample #n:
Constituent 1: (Sample conc. - background conc.) x Human toxicity value = _______
Constituent n: (Sample conc. - background conc.) x Human toxicity value = _______

Sum of element-products (hazard value) for sample #n = _______

5.2.3 Direct Contact Waste Characteristics Score

The waste characteristics score is calculated by multiplying the sample quantity value and the hazard value (calculated above) for each sample, summing the values for all samples from the source, and then dividing by 10,000:

Sample #1: Sample quantity value x sample #1 hazard value = ________

.

.

Sample #n: Sample quantity value x sample #n hazard value = ________

The direct contact waste characteristics score for each source is the sum of the sample products divided by 10,000.

5.3 DIRECT CONTACT TARGETS

The direct contact targets score is evaluated by assessing nearby receptors potentially affected by direct contact with waste constituents at the site. These values are the same as those used for the detailed (source specific) AIMSS, but may be different for different sources. If site specific information indicates more or fewer receptors, use that value if it can be documented.

5.3.1 Population Within One Mile

Population within a 1-mile radius of the site was determined from available census information for larger municipalities and from maps and field observations for smaller municipalities and rural populations. The one-mile distance is the same as the HRS target distance limit for the direct contact (soil exposure pathway). To account for uncertainty in the population figures, population is intervalized into ranges (ranges are from the HRS) and recorded on the site inventory form: 0; 1-10; 10-30; 30-100; 100-300; 300-1,000; 1,000-3,000; 3,000-10,000; and >10,000. The lower value of the range is used to be conservative in assigning a population score. This value is assigned as the population within one mile.

5.3.2 Distance to Nearest Residence

The nearest residence score is an adjustment used to emphasize the relatively greater risk to persons living close to the site (per the HRS). The distance to the nearest residence was observed during the site visit and recorded on the inventory form. Only the nearest residence is used (full-time or recreational use), regardless of the number or frequency of persons living at the residence. Assign a value as follows: less than 1,000 feet = 10; between 1,000 feet and 1/2 mile = 5; and more than 1/2 mile = 0.

5.3.3 Recreational Use

Recreational use of the site is an adjustment to account for direct contact with site wastes by persons who use the site for recreation, but do not live within the one-mile radius around the site. The value is assigned based on an evaluation of several criteria, collectively referred to as "attractiveness" in the HRS: proximity to populated areas, heavily travelled roads, or other recreation areas; uncommon features of the site which may attract recreationists (e.g., motorcyclists); and the amount of physical evidence of recreational use observed at the site. Assign a value as follows: high recreational use = 10; moderate use = 5; low use = 2; and no use = 0.

5.3.4 Direct Contact Targets Score

The direct contact targets score is the sum of the above three values: population within one mile, nearest residence, and recreational use.

5.4 DIRECT CONTACT SCORE

The Direct Contact Score is the product of the Direct Contact Likelihood of Exposure Score (Section 5.1), the Direct Contact Waste Characteristics Score (Section 5.2), and the Direct Contact Targets Score (Section 5.3).

6.0 RECLAIMED MINE SITE SCORE

Sum the four pathway scores and divide by 100,000 to obtain the reclaimed score for each source at the site. [Groundwater Pathway Score (Section 2.4) + Surface Water Pathway Score (Section 3.4) + Air Pathway Score (Section 4.4) + Direct Contact Score (Section 5.4)] / 100,000 = Reclaimed Source Score. The sum of scores for each source at the site (reclaimed and unreclaimed) is the total Reclaimed Mine Site Score.

For de-listing purposes, the same cutoff value is used as the original AIMSS. If a reclaimed site scores less than 0.04, it has been effectively reclaimed as it relates to AMRB's resource allocation and can be removed from AMRB's priority list.

7.0 SITE SAFETY SCORE

The site safety score is evaluated using the following factors: the safety threat (accessibility), safety hazards, and safety targets. The product of these three factors divided by 1,000 is the site safety score.

7.1 SAFETY THREAT AFTER RECLAMATION

The potential threat of human contact with safety hazards at a site is evaluated using the relative accessibility to the safety hazard. Accessibility is evaluated with respect to the presence of fences, signs, physical barriers, gates, or guards, that restrict access by residents or recreational users to the site hazards. These access restrictions must be intact and at least partially effective at limiting access by people. The most easily accessible hazard is scored as follows: easily accessible - no fences, gates, or signs = 20; moderately accessible - barbed wire fences, road gated, and signs posted = 10; difficult access - chain link fence, road gated and locked = 5; and not accessible - site completely fenced, access road gated and locked, site guarded (does not include locked or manned access points more than 1/2 mile from the actual abandoned mine site) = 1. The accessibility score is the same as the accessibility score in the Direct Contact Section (5.1.1).

7.1.1 Safety Threat Score

The safety threat score is the accessibility of site hazards (Maximum = 20).

7.2 SAFETY HAZARDS AFTER RECLAMATION

Safety hazards at the site are scored using the product of the quantity of various hazards and the relative hazard value assigned for each type of hazard remaining after reclamation at the site.

Sum the number of remaining open, hazardous, near-vertical stopes and shafts. Open means an opening that is large enough for a child to fall into, hazardous means that the sides of the opening are steep enough that the opening could not be exited easily (i.e., by a child).

Sum the number of remaining open adits or near-horizontal openings, that are large enough and open enough for a curious child to enter.

Sum the number of remaining unstable highwalls or open pits. Unstable refers to slopes, cuts, undercut banks, or piles that are at a slope that is greater than the angle of repose.

Sum the number of remaining hazardous structures at the site. Hazardous refers to structurally unstable buildings, not all old buildings at the site.

Note whether explosives (includes blasting caps and decomposed explosives) remain on the site.

Note whether other hazardous materials (asbestos, chemicals, not including petroleum products) remain on the site.

Each hazard is scored separately by multiplying the quantity of each hazard by a hazard score to determine a hazard value. Assign hazard values as follows:

Hazard and quantity	Score	Hazard Value
Number of shafts and stopes	x 100	= _____
Number of adits and tunnels	x 50	= _____
Number of pits and unstable highwalls	x 75	= _____
Number of hazardous structures	x 40	= _____
Explosives present on site	= 50	_____
Other hazardous materials present	= 100	_____

7.2.1 Safety Hazards Score

The safety hazards score is the sum of all of the above hazard values.

7.3 SAFETY TARGETS

The safety targets score is evaluated in the same manner as the direct contact targets.

7.3.1 Population Within One Mile

Population within a 1-mile radius of the site is the same as in the direct contact targets section.

7.3.2 Distance to Nearest Residence

The nearest residence score is the same as in the direct contact targets section.

7.3.3 Recreational Use

The recreational use score is the same as in the direct contact targets section.

7.3.4 Safety Targets Score

The safety targets score is the sum of the above three values: population within one mile, nearest residence, and recreational use.

7.4 SITE SAFETY SCORE

The Site Safety Score is the product of the Safety Threat Score (Section 7.1), the Safety Hazards Score (Section 7.2), and the Safety Targets Score (Section 7.3) divided by 1,000.

8.0 REFERENCES

Federal Register, 1990. 40 CFR Part 300, Appendix A, 1990. Hazard Ranking System; Final Rule. Federal Register, Vol. 55, No. 241, Pages 51532-51667. Friday, December 14, 1990; Effective Date: March 14, 1991.

MDEQ/AMRB-Pioneer, 1994. Abandoned and Inactive Mine Scoring System. Prepared for MDEQ/AMRB by Pioneer Technical Services, Inc., June 1994.

SCDM, 1994. Superfund Chemical Database Matrix (SCDM), Hazardous Substance Factor Values (333 Substances), June 1994 version.

APPENDIX A

EXAMPLE RECLAIMED SITE SCORING, BROOKLYN MINE AND MILLSITE

The Brooklyn Mine and Millsite was reclaimed in 1995 as a joint effort by the AMRB and the USFS. The reclamation included the following treatments for the wastes at the site.

Waste rock dumps WR-1, WR-2, and WR-3 were not in the 100-year floodplain and were reclaimed similarly, including:

1) grading out the waste rock dumps, reducing and stabilizing the slopes;
2) amending the upper 12-18 inches of the graded dumps with lime to neutralize acid-generation potential;
3) placing a one- foot deep organic-amended soil cover on the wastes, erosion control blankets where slopes were greater than 2.5 to 1, and applying a seed mix for revegetation;
4) constructing run-on control measures and run-off collection ditches and basins; and
5) fencing reclaimed sources.

For each of these three waste sources, these measures constitute three of the five requirements for groundwater protection (containment value of 1), three of the five requirements for surface water protection (containment value of 0.1), and meet the requirement for air and direct contact protection (containment values of 0.1 for both).

An on-site repository was constructed to contain waste materials that were in the 100-year floodplain (WR-5 and WR-6) and the mill tailings (TP-1) which were eroding directly into surface water. Additionally, mill tailings from the Nonpareil Millsite located west of the Brooklyn site (TP-1, -2, -3, and -4) were removed and placed in the repository. The repository was constructed with the following parameters:

1) applying an impermeable underliner beneath the waste materials with an integral leachate collection system;
2) applying an impermeable cap over the waste materials with a drainage layer above the cap;
3) placing a two-feet deep organic-amended soil cover over the cap system and applying a seed mix for revegetation;
4) constructing run-on control measures and run-off collection ditches and basins; and
5) constructing fence and repository.

For each of these four waste sources, these measures constitute four of the five requirements for groundwater protection (containment value of 0.1), three of the five requirements for surface water protection (containment value of 0.1), and meet the requirement for air and direct contact protection (containment values of 0.1 for both).

RMSS SCORESHEET

SITE NAME: BROOKLYN MINE AND MILL
PA NUMBER: 20-025

LINE NO.			SOURCE:	Total Site	Repository TP1, WR5&6 Nonpareil tails	Reclaimed WR1	Reclaimed WR2	Reclaimed WR3
		GROUNDWATER PATHWAY						
1	GW - LIKELIHOOD OF RELEASE	CONTAINMENT	0/5=20; 1/5=10; 2/5=5; 3/5=1; 4/5=0.1; All=0.05		0.1	1.0	1.0	1.0
2		GW DEPTH	<25'=20; 25-100'=10; >100'=2		10	2	2	10
3		LIKELIHOOD SCORE	LINES 1 x 2		1.0	2.0	2.0	10.0
4	GW - WASTE CHAR.	RECALCULATED SCORE	(SEE APPENDIX B)		37.106	6.396	21.721	16.766
5	GW - TARGETS	WELLS - 1 MI. x 2.5	#Wells <1 mi. (MBMG) x 2.5		0.0	0.0	0.0	0.0
6		WELLS - 1 TO 4 MI	#Wells 1-4 mi. (MBMG)		11	11	11	11
7		NEAREST WELL	<1000'=20; 1000-2640'=10; >2640'=2		0	0	0	0
8		TARGETS SCORE	LINES 5 + 6 + 7		11.0	11.0	11.0	11.0
9		**GROUNDWATER SCORE**	LINES 3 x 4 x 8	2871	408	141	478	1844
		SURFACE WATER PATHWAY						
10	SW - LIKELIHOOD OF RELEASE	CONTAINMENT	None=20; One=10; Two=1; All=0.1		0.1	0.1	0.1	0.1
11		DISTANCE TO SW	<25'=20; 25-100'=10; >100'=2		2	2	2	2
12		LIKELIHOOD SCORE	LINES 10 x 11		0.2	0.2	0.2	0.2
13	SW - WASTE CHAR.	RECALCULATED SCORE	(SEE APPENDIX B)		39.909	6.890	23.553	18.088
14	SW - TARGETS	DRINKING WATER POP'N	#Served (WQB) x Dilution Factor		0	0	0	0
15		IMPACTED DRAINAGE	Impacted Distance in feet / 1,000		0	0	0	0
16		WETLANDS	MDFWP - No=0 ; Yes=10		10	10	10	10
17		FISHERY	Class: 1=20 ; 2=10; 3=5; 4=1; else=0		5	5	5	5
18		RECREATION	Use? No=0 ; Yes=2		0	0	0	0
19		IRRIGATION/STOCK	Use? No=0 ; Yes=2		0	0	0	0
20		T & E SPECIES HABITAT	MDNRC - No=0 ; Yes=5		5	5	5	5
21		TARGETS SCORE	SUM LINES 14 - 20		20	20	20	20
22		**SURFACE WATER SCORE**	LINES 12 x 13 x 21	354	160	28	94	72
		AIR PATHWAY						
23	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT	Cover=0.1; No=1; Low=10; Mod=15; High=20		0.1	0.1	0.1	0.1
24		DISTANCE TO POP'N	<1000'=20; 1000-2640'=10; >2640'=5		5	5	5	5
25		LIKELIHOOD SCORE	LINES 23 x 24		0.5	0.5	0.5	0.5
26	AIR - WASTE CHAR.	RECALCULATED SCORE	(SEE APPENDIX B)		0.011	0.002	0.008	0.006
27	AIR - TARGETS	POPULATION - 4 MILES	0; 1; 10; 30; 100; 300; 1K; 3K; 10K		1	1	1	1
28		NEAREST RESIDENCE	<1000'=10; 1000-2640'=5; >2640'=0		0	0	0	0
29		WETLANDS	MDFWP - No=0 ; Yes=10		10	10	10	10
30		PARKS / WILDERNESS	No=0 ; Yes=10		0	0	0	0
31		T & E SPECIES HABITAT	MDNRC - No=0 ; Yes=5		5	5	5	5
32		TARGETS SCORE	SUM LINES 27 - 31		16	16	16	16
33		**AIR PATHWAY SCORE**	LINES 25 x 26 x 32	0	0	0	0	0
		DIRECT CONTACT PATHWAY						
34	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY	Easy=20; Mod=10; Diff=5; None=1; Cover=0.1		0.1	0.1	0.1	0.1
35		DISTANCE TO POP'N	<1000'=20; 1000-2640'=10; >2640'=5		5	5	5	5
36		LIKELIHOOD SCORE	LINES 34 x 35		0.5	0.5	0.5	0.5
37	D. C. WASTE CHAR.	RECALCULATED SCORE	(SEE APPENDIX B)		0.010	0.002	0.007	0.006
38	DIRECT CONTACT TARGETS	POPULATION - 1 MILE	0; 1; 10; 30; 100; 300; 1K; 3K; 10K		0	0	0	0
39		NEAREST RESIDENCE	<1000'=10; 1000-2640'=5; >2640'=0		0	0	0	0
40		RECREATIONAL USE	None=0; Low=2; Mod=5; High=10		2	2	2	2
41		TARGETS SCORE	SUM LINES 38 - 40		2	2	2	2
42		**DIRECT CONTACT SCORE**	LINES 36 x 37 x 41	0	0	0	0	0
43	**RECLAIMED MINE SITE SCORE**	(LINES 9 + 22 + 33 + 42) / 100,000		**0.0322**	0.0057	0.0017	0.0057	0.0192

	SITE SAFETY			Total Site
1	THREAT REMAINING	ACCESSIBILITY	Easy=20; Mod=10; Diff=5; None=1; Fixed=0.1	0.1
2		OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	0
4	HAZARDS REMAINING	UNSTAB. HIWALLS / PITS	75 EA.	0
5		HAZ. STRUCTURES	40 EA.	120
6		EXPLOSIVES		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 - 7	120
9		POPULATION - 1 MILE		0
10	TARGETS	NEAREST RESIDENCE		0
11		RECREATIONAL USE		2
12		TARGETS SCORE	SUM LINES 9 - 11	2
13		**SITE SAFETY SCORE**	(LINES 1 x 8 x 12) / 1,000	**0.02**

APPENDIX B

EXAMPLE RECLAIMED SITE WASTE CHARACTERISTICS SCORING, BROOKLYN MINE AND MILLSITE

Waste characteristics scores were derived for the initial AIMSS scoring for the Brooklyn site in 1993. These scores were refined for each of the sources at the site in the preliminary risk analysis section of the Reclamation Work Plan prepared in 1994. Refining these scores after reclamation may be necessary because additional concentration data were collected during the reclamation investigation and more accurate volume and area determinations are available from both the investigation and the reclamation activity. Most reclamation activities do not change the volume or composition of the waste materials; hence, for scoring purposes, the waste characteristics are the same as before the reclamation occurred.

The following pages demonstrate the derivation of the waste characteristics scores for each of the waste sources at the Brooklyn site (WR-1, -2, -3, -5, -6, TP-1, and the Nonpareil tailings). At the end of the calculations, the scores for all the wastes that were placed in the repository were combined for calculating the RAIMSS score in Appendix A.

		Reclaimed Brooklyn WR1	Reclaimed Brooklyn WR2	Reclaimed Brooklyn WR3	Repository Brooklyn WR5,6	Repository Brooklyn TP1	Repository Nonpareil TP1,2,3,4	
Antimony	Source Concentration	97.80	331.00	529.00	35.00	347.00	282.00	Weighted Average
	Background Conc.	8.90	8.90	8.90	8.90	8.90	10.50	Sample(s)
	Corrected Concentratio	88.90	322.10	520.10	26.10	338.10	271.50	Source Conc. - Background Conc.
	Human Toxicity Value	10.00	10.00	10.00	10.00	10.00	10.00	From table, after EPA HRS (SCDM)
	Human Hazard	889.00	3221.00	5201.00	261.00	3381.00	2715.00	Corrected Conc. X Human Toxicity Value
	Ecotoxicity Value	0.00	0.00	0.00	0.00	0.00	0.00	From table, after EPA HRS (SCDM)
	Ecologic Hazard	0.00	0.00	0.00	0.00	0.00	0.00	Corrected Conc. X Ecotoxicity Value
Arsenic	Source Concentration	618.00	793.00	430.00	186.00	507.00	360.00	
	Background Conc.	25.60	25.60	25.60	25.60	25.60	39.20	
	Corrected Concentratio	592.40	767.40	404.40	160.40	481.40	320.80	
	Human Toxicity Value	10.00	10.00	10.00	10.00	10.00	10.00	
	Human Hazard	5924.00	7674.00	4044.00	1604.00	4814.00	3208.00	
	Ecotoxicity Value	0.01	0.01	0.01	0.01	0.01	0.01	
	Ecologic Hazard	5.92	7.67	4.04	1.60	4.81	3.21	
Barium	Source Concentration	293.00	455.00	481.00	249.00	968.00	433.00	
	Background Conc.	74.00	74.00	74.00	74.00	74.00	157.00	
	Corrected Concentratio	219.00	381.00	407.00	175.00	894.00	276.00	
	Human Toxicity Value	10.00	10.00	10.00	10.00	10.00	10.00	
	Human Hazard	2190.00	3810.00	4070.00	1750.00	8940.00	2760.00	
	Ecotoxicity Value	0.001	0.001	0.001	0.001	0.001	0.001	
	Ecologic Hazard	0.22	0.38	0.41	0.18	0.89	0.28	
Cadmium	Source Concentration	7.900	34.000	11.500	9.700	48.300	23.100	
	Background Conc.	0.900	0.900	0.900	0.900	0.900	1.700	
	Corrected Concentratio	7.000	33.100	10.600	8.800	47.400	21.400	
	Human Toxicity Value	10.00	10.00	10.00	10.00	10.00	10.00	
	Human Hazard	70.00	331.00	106.00	88.00	474.00	214.00	
	Ecotoxicity Value	1.00	1.00	1.00	1.00	1.00	1.00	
	Ecologic Hazard	7.00	33.10	10.60	8.80	47.40	21.40	
Chromium	Source Concentration	8.10	8.50	4.60	4.60	3.80	2.16	
	Background Conc.	9.80	9.80	9.80	9.80	9.80	12.10	
	Corrected Concentratio	0.00	0.00	0.00	0.00	0.00	0.00	
	Human Toxicity Value	10.00	10.00	10.00	10.00	10.00	10.00	
	Human Hazard	0.00	0.00	0.00	0.00	0.00	0.00	
	Ecotoxicity Value	10.00	10.00	10.00	10.00	10.00	10.00	
	Ecologic Hazard	0.00	0.00	0.00	0.00	0.00	0.00	
Cobalt	Source Concentration	14.40	7.10	4.30	3.30	3.30	1.64	
	Background Conc.	7.40	7.40	7.40	7.40	7.40	7.70	
	Corrected Concentratio	7.00	0.00	0.00	0.00	0.00	0.00	
	Human Toxicity Value	0.001	0.001	0.001	0.001	0.001	0.001	
	Human Hazard	0.01	0.00	0.00	0.00	0.00	0.00	
	Ecotoxicity Value	0.00	0.00	0.00	0.00	0.00	0.00	
	Ecologic Hazard	0.00	0.00	0.00	0.00	0.00	0.00	
Copper	Source Concentration	1483.00	394.00	218.00	124.00	630.00	159.00	
	Background Conc.	19.80	19.80	19.80	19.80	19.80	16.50	
	Corrected Concentratio	1463.20	374.20	198.20	104.20	610.20	142.50	
	Human Toxicity Value	0.00	0.00	0.00	0.00	0.00	0.00	
	Human Hazard	0.00	0.00	0.00	0.00	0.00	0.00	
	Ecotoxicity Value	0.10	0.10	0.10	0.10	0.10	0.10	
	Ecologic Hazard	146.32	37.42	19.82	10.42	61.02	14.25	
Iron	Source Concentration	36900.0	25147.0	14693.0	11543.0	17567.0	14900.0	
	Background Conc.	16050.0	16050.0	16050.0	16050.0	16050.0	14200.0	
	Corrected Concentratio	20850.0	9097.0	0.0	0.0	1517.0	700.0	
	Human Toxicity Value	0.00	0.00	0.00	0.00	0.00	0.00	
	Human Hazard	0.00	0.00	0.00	0.00	0.00	0.00	
	Ecotoxicity Value	0.01	0.01	0.01	0.01	0.01	0.01	
	Ecologic Hazard	208.50	90.97	0.00	0.00	15.17	7.00	
Lead	Source Concentration	1250.00	5746.00	4264.00	506.00	3807.00	3110.00	
	Background Conc.	31.80	31.80	31.80	31.80	31.80	51.00	
	Corrected Concentratio	1218.20	5714.20	4232.20	474.20	3775.20	3059.00	
	Human Toxicity Value	10.00	10.00	10.00	10.00	10.00	10.00	
	Human Hazard	12182.00	57142.00	42322.00	4742.00	37752.00	30590.00	
	Ecotoxicity Value	1.00	1.00	1.00	1.00	1.00	1.00	
	Ecologic Hazard	1218.20	5714.20	4232.20	474.20	3775.20	3059.00	

		Reclaimed Brooklyn WR1	Reclaimed Brooklyn WR2	Reclaimed Brooklyn WR3	Repository Brooklyn WR5,6	Repository Brooklyn TP1	Repository Nonpareil TP1,2,3,4	
Mercury	Source Concentration	5.6100	15.9000	9.6100	12.7000	8.9400	1.2200	Weighted Average
	Background Conc.	0.0900	0.0900	0.0900	0.0900	0.0900	0.1400	Sample(s)
	Corrected Concentratio	5.5200	15.8100	9.5200	12.6100	8.8500	1.0800	Source Conc. - Background Conc.
	Human Toxicity Value	10.00	10.00	10.00	10.00	10.00	10.00	From table, after EPA HRS (SCDM)
	Human Hazard	55.20	158.10	95.20	126.10	88.50	10.80	Corrected Conc. X Human Toxicity Value
	Ecotoxicity Value	10.00	10.00	10.00	10.00	10.00	10.00	From table, after EPA HRS (SCDM)
	Ecologic Hazard	55.20	158.10	95.20	126.10	88.50	10.80	Corrected Conc. X Ecotoxicity Value
Nickel	Source Concentration	22.60	27.80	18.60	31.70	11.30	2.13	
	Background Conc.	11.40	11.40	11.40	11.40	11.40	9.10	
	Corrected Concentratio	11.20	16.40	7.20	20.30	0.00	0.00	
	Human Toxicity Value	0.10	0.10	0.10	0.10	0.10	0.10	
	Human Hazard	1.12	1.64	0.72	2.03	0.00	0.00	
	Ecotoxicity Value	0.01	0.01	0.01	0.01	0.01	0.01	
	Ecologic Hazard	0.11	0.16	0.07	0.20	0.00	0.00	
Zinc	Source Concentration	802.00	6640.00	4725.00	2064.00	6517.00	3260.00	
	Background Conc.	68.30	68.30	68.30	68.30	68.30	116.00	
	Corrected Concentratio	733.70	6571.70	4656.70	1995.70	6448.70	3144.00	
	Human Toxicity Value	0.01	0.01	0.01	0.01	0.01	0.01	
	Human Hazard	7.34	65.72	46.57	19.96	64.49	31.44	
	Ecotoxicity Value	0.01	0.01	0.01	0.01	0.01	0.01	
	Ecologic Hazard	7.34	65.72	46.57	19.96	64.49	31.44	
Source Human Hazard		21318.66	72403.46	55885.49	8593.09	55513.99	39529.24	
	Sum of human hazard values for each contaminant							
Source Ecologic Hazard		1648.81	6107.73	4408.91	641.46	4057.49	3147.37	
	Sum of ecohazard values for each contaminant							
Source Volume (cu.yd.; corrected)		5750	4000	7200	13400	4900	4500	Measured at site
Quantity Value (volume - GW & SW		3	3	3	10	3	3	Assigned from range on table
Exposed Source Area (sq.ft./100)		0	0	0	0	0	0	Measured at site
Quantity Value (area - Air & DC)		0.001	0.001	0.001	0.001	0.001	0.001	Assigned from range on table

	Brooklyn WR1	Brooklyn WR2	Brooklyn WR3	Brooklyn WR5,6	Brooklyn TP1	Nonpareil TP1,2,3,4	Total Repository
Groundwater Waste Char. Score	6.3956	21.7210	16.7656	8.5931	16.6542	11.8588	37.1061
Source human hazard X quantity value / 10,000							
Suface Water Waste Char. Score	6.8902	23.5534	18.0883	9.2345	17.8714	12.8030	39.9090
[Source human hazard + source ecologic hazard] X quantity value / 10,000							
Air Waste Char. Score	0.0023	0.0079	0.0060	0.0009	0.0060	0.0043	0.0111
[Source human hazard + source ecologic hazard] X quantity value / 10,000							
Direct Contact Waste Char. Score	0.0021	0.0072	0.0056	0.0009	0.0056	0.0040	0.0104
Source human hazard X quantity value / 10,000							

VIDEO TAPE LOG

CASCADE

NEIHART

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY SITE INVESTIGATION LOG SHEET

Mine/Site Name: IXL/EUREKA **PA#:** 07-083

Date: September 24, 1995 **Time:** 1330-1630

Field Team Leader: Tuesday, Pioneer

Sampling Personnel: Flammang, Pioneer
Sampson, Pioneer

Visitors: None

Weather/Seasonality Observations: Cool; sunny.

Photographic Log (Photo No.'s/Video Tape Number)**:** #5: WR-1 from below; #6: WR-2 from north; #7: Fenced open shaft at WR-2; #8: Adit discharge (AD-1 sample location), open adit and highwall at WR-3; #9: South side of WR-3 (Note: Undercut bank); #10: WR-3 from north; #11: Dry, iron-stained drainage at base of WR-3; #12: Open adit below WR-3; #13: Open adit at WR-4; #14: WR-4 from above. Video Tape No. 1

General Comments/Observations (not covered specifically in attached Inventory Forms)**:** Site includes four individually inventoried sites: IXL/Eureka (07-083); Lower IXL (07-170); Upper West Eureka (07-171); and Lower West Eureka (07-172).

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Remove WR-3 from drainage and discharge. Cover and revegetate dumps. Fill open shaft at WR-2.

I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): IXL/EUREKA **PA#:** 07-083

Legal Description: T 14N ;R 8E ;Sec. 28 , NW 1/4 NE 1/4 ____ 1/4

County: CASCADE **Mining District:** NEIHART

Latitude: N 46° 57' 03-08" **Longitude:** W 110° 42' 43-48"

Primary Drainage Basin and Code: Belt Creek/10030105
Secondary Drainage Basin: Snow Creek/Carpenter Creek
USGS Quadrangle map name(s): Neihart

Mine Type/Commodities: Hardrock/Silver, Lead, Zinc
Activity Status: Active ___, Inactive/Exploration X , Abandoned ___.

Ownership status: Known Y X N ___; **private/public?** Private
Owner, Agent, or Contact (Include address and phone when available)**:** Paul Hatfield, Lexington Silver Lead Mines, Inc., Benton Group Mining Co., P.O. Box 323, Veradale, WA 99037.

Relationship to other mines/sites in the area/district: 1/4 mile northeast of Lucky Strike, 1/4 mile northwest of Big Seven, 1/2 mile south of Snow Creek Millsite

Regulatory Status (Activity by other agencies)? Hardrock permits? Past Reclamation Activities? Shaft has been fenced by AMRB.

General site features: **Elevation** 6680'-6880' , **Slope** 20°-30° , **Aspect** Northwest

Land use: Mining ___, Recreational X , Residential ___, Urban ___, Agricultural ___, Other(Specify) ___

Area of disturbed/unvegetated lands? 2.2 **acre(s).**
Site Dimensions: 250 feet x 200 feet (WR-1, WR-3); 100 feet x 125 (WR-2); 350 feet x 100 feet (WR-4, subsidence)

Predominant vegetation types: Lodgepole pines

Access: roads - good (paved) ___, poor (maintained dirt road) ___, 4wd X , trail X .
Other logistical considerations (proximity to other sites). 1/2 mile northwest of Big Seven; 1/2 mile north of Lexington; locked gate on Snow Creek Road, main access road to the area.

Well logs within 1 mile radius; (Attach MBMG Well Log Printout(s): There are 3 well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also note presence of radioactive minerals). The IXL and Eureka claims are on the north slope of the main ridge between Rock Creek and Snow Creek, about 2 miles northeast of Neihart. Water leaving the site would flow northwest in unnamed tributary of Snow Creek to Snow Creek approximately 1/2 mile below the site. Water would flow northwest 1/3 mile in Snow Creek to confluence with Carpenter Creek, which flows southwest to confluence with Belt Creek 2 miles downstream. Site is underlain by Snow Creek porphyry and pinto diorite.

Mining/milling history, ore type/tenor, host rock, gangue: Rocks on dumps appeared to be very bleached and either a fine-grained phase of porphyry or a volcanic.

Mine Operation?

Shafts - Yes X, No ___, # 1, Comment 250', 2 levels, fenced
Adits - Yes X, No ___, # 4, Comment 3 open, 1 collapsed
Pits - Yes X, No ___, # ___, Comment Numerous pits & trenches
Placers - Yes ___, No X, # ___, Comment ___
Other - Yes X, No ___, # 3, Comment Subsidence structures/ shafts, approx. 40' deep

Mill Operation? Yes ___, No X. If yes answer the next three questions:

Period(s) of Operation: N/A

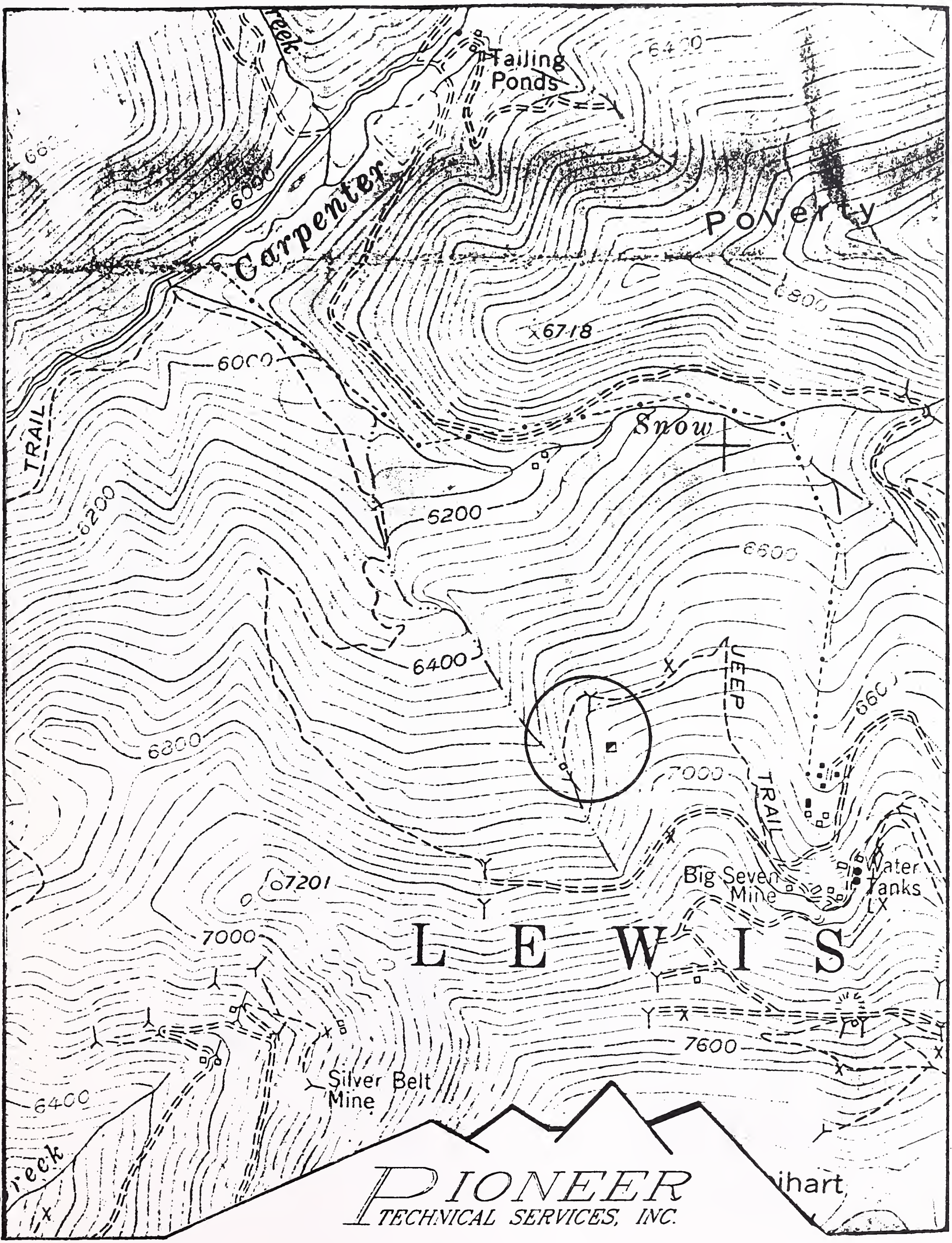
Origin of Ore Milled - Custom Mill___ Dedicated Mill___; Number and names of mines that supplied mill feed: N/A

Process? Hg-amalgam, CN$^-$ leach (vat, heap), floatation, smelting?
N/A

Montana Bureau of Mines and Geology
Water Well Log Data

08/10/1994

Well No.	Location	Depth	Yield	Static Water Level
123062	14N 08E 20 DBA	41.0	4.0	24.00
M:123061	14N 08E 20 DBA	40.0	7.0	0.00
M:25649	14N 08E 32 BDC	120.0	8.0	7.00

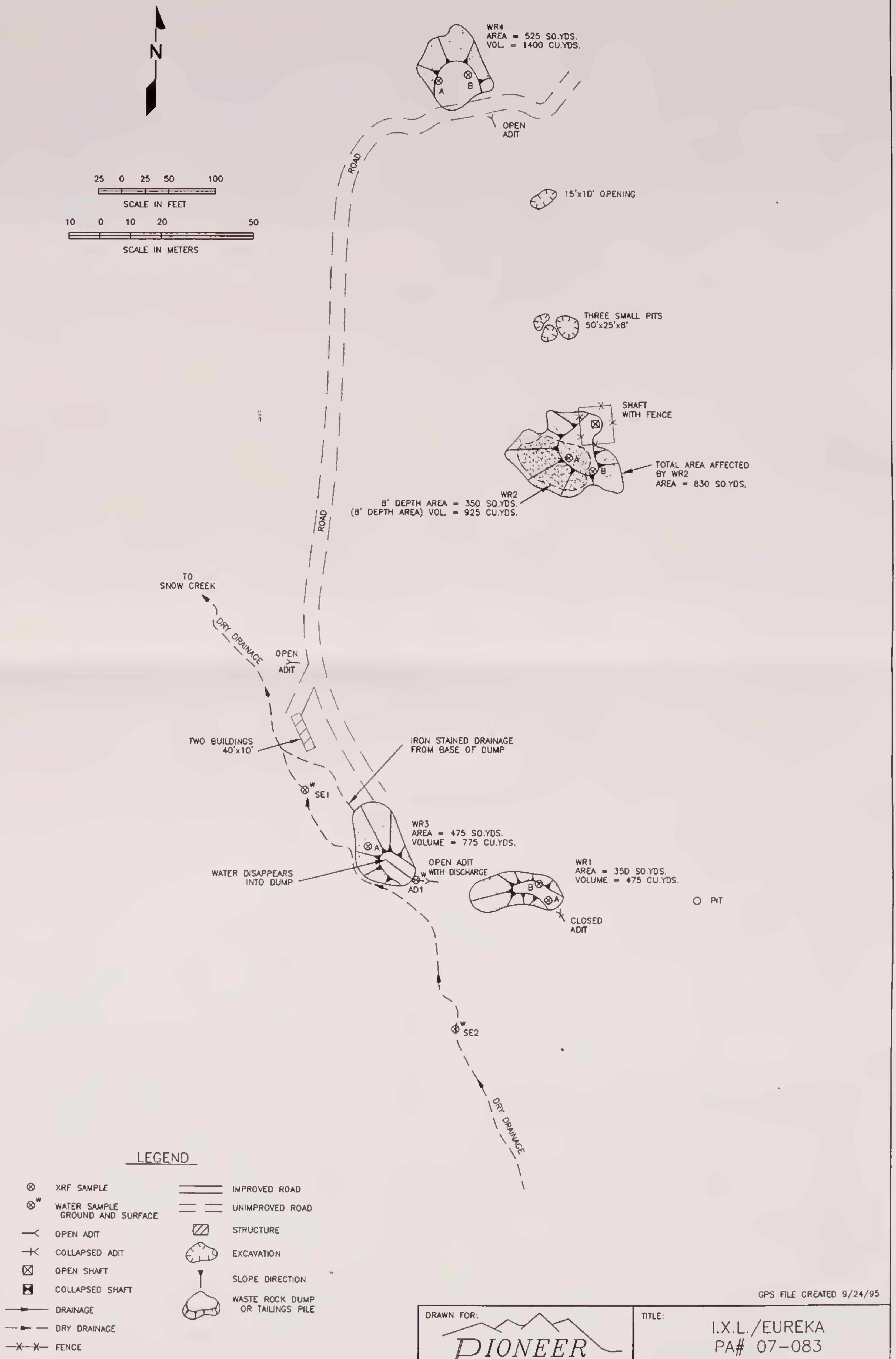


PIONEER
TECHNICAL SERVICES, INC.

IXL/EUREKA, P.A. NO. 07-083

T14N, R08E, SECTION 28

SCALE: 1" = 1000'



GPS FILE CREATED 9/24/95

DRAWN FOR:

PIONEER
TECHNICAL SERVICES, INC.
P.O. BOX 3445
BUTTE, MT 59702

TITLE:
I.X.L./EUREKA
PA# 07-083

DRAWING NO.: PT342109
DATE: 3/7/96
PLOT SCALE: 1 = 30

II. INFORMATION COLLECTED ON SITE

A. SOLID MATRIX WASTE CHARACTERIZATION

1. **Waste Characteristics** - *Use table on following page.*

Unique source identification: (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TP); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures/vessels sound, are runon/runoff controls in place, are wastes covered or vegetated, pond liners intact?

2. **TAILINGS IMPOUNDMENTS** - *If tailings impoundments are also present, complete the following questions.*

Describe the tailings grain size distribution (approximate % sand, silt, & clay): N/A

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): N/A

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): N/A

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): N/A

Comments on potential for mitigation: N/A

SOURCE INVENTORY FORM

SAMPLERS: Sampson

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd³)	LOCATION/DESCRIPTION	CONTAIN-MENT	pH SU (D/S)*	RADIO-ACTIVITY (mR/HR)	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
WR-1A	WR	475	Associated with collapsed adit; east side, south face	None	6.8	0.06	07-083-WR-1	09/25/95 1400	T-Metals, ABA
WR-1B	WR		Associated with collapsed adit; north side, north face	None	7.0	0.07			
WR-2A	WR	925	Associated with open shaft; north end, south face	None	6.6	0.07			
WR-2B	WR		Associated with open shaft; south end, west face	None	6.8	0.075			
WR-3	WR	775	Associated with open adit; north end, near top	None	< 3.5	0.05	07-083-WR-3	09/24/95 1500	T-Metals, ABA
WR-4A	WR	1,400	Associated with open adit, north area; west side, west face	None	7.0	0.065			
WR-4B	WR		Associated with open adit, north area; east side, east face	None	6.0	0.06			

* pH readings were taken directly on-site (Kelway Meter).

Comments or deviations from SOPs: 07-083-WR-1 is a composite of WR-1A, -1B, -2A, -2B, -4A, and -4B. 07-083-WR-3 is WR-3. Background sample was collected at the Ripple Mine (07-163-SS-1) during the 1994 investigation.

B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes _X_**, No**____**, Number:** _1__ **Identification:** __Sampled a
AD-1, associated with WR-3

Filled shafts: Yes___**, No** _X_**, Number:**____ **Identification:**______________

Seeps/Springs: Yes___**, No** _X_**, Number:**____ **Identification:**______________

Groundwater wells within 4 miles?: Yes _X_**, No**___**;**
Number of well logs: __8____

Distance to nearest well used for drinking:
___**<1,000 ft;**___**1,000 ft to 0.5 miles;** _X_**>0.5 miles.**

Sample types: Flowing adits (AD); filled shafts (SH); Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?
Definite____**, Probable**____**, Possible** _X__**, Unlikely**____**.**
High metals and low pH (WR-3); shallow groundwater

Approximate Depth to Groundwater: _X_**<25 ft;**___ **25 - 100 ft;**___ **>100 ft.**

Other observations/notes: __<25 feet in stream areas (WR-3); 25 - 100 feet on top (WR-1, -2, and -4)

GROUNDWATER INVENTORY FORM

SAMPLERS: Tuesday

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SOURCE	FLOW* cfs/gpm	pH SU	SC $\mu S/cm$ @ 25°C	Eh mV	Temp °C	ALK. mg/L as $CaCO_3$	Depth ft	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
AD-1	AD	Adit associated with WR-3	2 gpm (E)	6.38	146	191.3	3.8	11	N/A	07-083-AD-1	09/24/95 1400	T-Metals, TDS, Hardness, Cl, SO4

FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): ____________

C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/run-off) and directions on sketch maps.

Flowing streams: Yes____, No X , Name(s):

Dry streambeds: Yes X , No____, Name(s): Unnamed tributary to Snow Creek

Other surface water: Yes X , No____, Name(s)/Description: Adit discharge

Waste materials within any floodplain: Yes X , No____ Source ID(s): WR-3

Approximate Flood frequency? X 1 yr, ___10 yr, ___100 yr

Estimated seasonal flow of stream(s) (cfs/gpm)? 0 gpm

High Flow: 0.5 cfs , **Average Flow:** 0 gpm

Distance between waste source(s) and nearest surface water body (ft)?
0 feet - Adit discharge flows over and on west side of WR-3
0 feet - Unnamed tributary and WR-3, when tributary is flowing

Surface water draining onto or through waste sources: Yes X , No____,
Describe: Adit discharge flows over WR-3.

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)
Wetlands, fishery (Belt Creek)

Observed erosional/sedimentation/stream turbidity problems? Yes X , No____. **Distance downstream (ft)?** 0-500 X ; 500-1,000___; >1,000___.
Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present): Red staining present on rocks in dry creek bed. WR-3 is being undercut by drainage.

SURFACE WATER INVENTORY FORM

SAMPLERS: Flammang, Sampson

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SAMPLE LOCATION	pH SU	SC $\mu S/cm$ @ 25°C	Temp °C	ALK. mg/L as $CaCO_3$	Flow* cfs/gpm	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
SE-1	SE	Below WR-3	N/A	N/A	N/A	N/A	0	07-083-SE-1	09/24/95 1540	T-Metals
SE-2	SE	125 feet above WR-3, above influence of WR-1	N/A	N/A	N/A	N/A	0	07-083-SE-2	09/24/95 1530	T-Metals

*FLOW: Estimated (E) or Measured (M)?

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

AMD Characteristics:

Presence and abundance of sulfides?	*(SO_3)*
Presence of evaporative salt deposits?	*(ESD)*
Discolored or turbid seepage?	*(SPG)*
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	*(FEOX)*
Presence of burned or stressed vegetation?	*(VEG)*
pH ≤ 5.0	*(pH)*

General Potential for AMD Mitigation:

Area available for treatment (acres)? None

Wetlands present: Yes___, No X, Describe:

Carbonate rocks/soils: Yes___, No X, Describe:

E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10___; 10-30___; 30-100 X; 100-300___; 300-1,000___; 1,000-3,000___; 3,000-10,000___; 10,000 or greater___; Comments Town of Neihart

Nearest residence:___<1,000 ft;___1,000 ft - 0.5 miles; X >0.5 miles.

For each source (table next page):

Available fine materials? Surface area?

Uncovered and unvegetated? Wet or dry?

Overall dust propagation potential:
observed high moderate low none

ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

SAMPLERS: Sampson, Tuesday

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LIST)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/HIGH/MODERATE/LOW/NONE)
WR-1	None	Dry	3,150	3,150	No	Low
WR-2	None	Dry	7,470	7,470	No	Low
WR-3	SO3; pH	Partial	4,275	4,275	No	Low
WR-4	None	Dry	4,725	4,725	No	Low
AD-1	FEOX; Algae	N/A	N/A	N/A	N/A	N/A

Notes and Clarifications:

F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes_____, No_X__,
Describe:____

Population within 1 mile: 1-10_X_; 10-30___; 30-100___; 100-300___;
300-1,000____; 1,000-3,000____; 3,000-10,000____; 10,000 or greater____;
Comments____

Evidence of recreational use on site: Yes___, No_X_, Describe:________

Accessibility (check each that apply):___Easily accessible - no fences, gates, or warning signs;_X_Moderately Accessible - barbed wire fences, road gated, or signs posted;____Difficult Access - chain-link fence, road gated and locked, site guarded (does not include locked or manned access points located more than 0.5 miles from the actual site).

Sensitive environments on-site or adjacent to site:
State or National Parks - Yes___, No_X_, Comment________________
Wilderness Area - Yes___, No_X_, Comment________________
T&E Species Habitat - Yes___, No_X_, Comment________________
Bat Habitat - Yes_X_, No___, Comment_3 open adits_______

Primary Drainage___; Secondary Drainage_X_; No Information___:
Riparian Habitat Quality - High___, Medium_X_, Low___
Wetlands Frontage - High___, Medium___, Low_X_
Fisheries Habitat and Species Classification - _4_
Sport Fishery Classification - _3_

G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes_X_, No___, Number_7__, types and locations:___ Fenced shaft at WR-2; 3 open adits, at WR-3, below WR-3, and at WR-4; 3 shafts/subsidence structures (40' deep) above WR-4.

Hazardous structures: Yes_X_, No___, Number_1__, types and locations:_ Partially collapsed building below WR-3

Unstable highwalls, pits, trenches, slopes: Yes_X_, No___, Number_5__, types and locations:_ 3 shafts/subsidence structures with rock bridges between appear to be caving in WR-4 area; small highwall associated with WR-3 (AD-1), highwall associated with adit below WR-3.

Unstable waste piles, impoundments, undercut banks: Yes_X_, No____, Number_2__, types and locations:_ WR-3 is caving on streambed side (recently, was not there in August); WR-1 is steep and at angle of repose.

Fire and/or Explosion hazards: Yes___, No_X_, Explain:________________

Bibliography

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MBMG, Well Log Database, July 14, 1994.

MDFWP, Montana Rivers Information System Rivers Report, Prepared by Montana Natural Resource Information System, July 1995.

MDHES/SHWB, Superfund Basics, Overview and Accomplishments of Superfund in Montana 1983-1993, November 1993.

MDEQ/AMRB Files, Abandoned Mine Reclamation Portal Inventory Form for I.X.L.-Eureka, Prepared by Daphne Digrindakis, June 13, 1985.

MDEQ/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for Lower I.X.L., Prepared by Chen-Northern, October 26, 1989.

MDEQ/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for Lower West Eureka, Prepared by Chen-Northern, October 26, 1989.

MDEQ/AMRB Files, Hazardous Materials Inventory Site Investigation Log Sheet for Lexington No. 4, Prepared by Pioneer Technical Services, Inc., June 9, 1994.

USBM, Mines and Mineral Deposits (Except Fuels), Cascade County, Montana, Information Circular No. 7589, Written by Almon F. Robertson, April 1950.

USGS, Topographic Map, Neihart, Montana, 7 1/2 minute Quadrangle, 1961.

LABORATORY ANALYTICAL DATA

I.X.L./EUREKA
PA NO. 07-083

I.X.L./ EUREKA (all 4 sites) PA# 07-083
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/24/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
07-083-SE-1	5.4 UJ	29.3 J	44.4	9.2	1590	15.6	7.2	72.6	38300	428 JX	3800 J	1660	0.055	12.8	8.8	1450	NR
07-083-SE-2	4.9 UJ	43.7 J	95.4	20.8	2680	17.5	12.2	55.2	25400	681 JX	7360 J	4250	0.049	27.4	1.1	2500	NR
07-083-WR-1	68.2 J	36.0	15.0	7.0 J	19.3	1.6 U	1.8 U	59.9	9810	2880	56.8	25.6	4.3	2.3 U	45.2	1590 J	NR
07-083-WR-3	6.3 UJ	97.7	16.6 J	6.5 J	35900	2.0 U	2.2 U	33.4 JX	83700	3130	46.2	12.5	0.48	2.8 U	27.6	581	NR
BACKGROUND	4 7 UJ	9.6	87.6	1.32 JX	NR	27.2 J	9.05 J	10.8 J	21100	52.4 JX	NR	708 J	0.04	10.3	0.5 B	135	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Bass Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Bass Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
07-083-WR-1	0 29	9 06	-1.33	-10.4	0.18	0.01	0.10	0.31	-1.64	-1.64	-3.44	7.66	-11.23	-23 59
07-083-WR-3	9.09	284	-6.56	-291	0.15	1.62	7.32	50.6	-57.20	-57.20	-120.12	282.89	-361.81	-759 81

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Al (ug/L)	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
07-083-AD-1	103 JX	2.7 UJ	1.2 U	4.8 U	1.1	18500	9.6 U	10.9 U	4 4 U	709	3.5	3700	99.4	0.16 U	17.7	0.21 U	340	61.5

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
07-083-AD1	103	< 5	40.0	NR	NR

Legend

SE-1- Immediately below WR-3.
SE-2- Upstream above WR-1 & WR-3.
WR-1- Composite WR1A, 1B, 2A, 2B, 4A, 4B.
WR-3- WR-3.
BACKGROUND- From the Ripple (07-163-SS1) (1994 data).
AD-1- Adit at WR-3.

XRF ANALYSIS RESULTS

I.X.L./EUREKA
PA NO. 07-083

Mine Name: IXL/Eureka PA No. 07-083
XRF Field Analyses
Results in PPM

XRF SAMPLE I.D.	CrHI	K	Ca	Tl	CrLO	Mn	Fe	Co	Ni	Cu	Zn	As	Se
07-083-WR1A		34731	1117.4 *	633.04 *			15003			119.78 *	1512.7		
07-083-WR1B		34804	1282.8 *	932.97	230.81 *		28095				231.7		
07-083-WR2A		29699	1523.7	503.23 *	350.51 *		11757	351.25 *		71.966 *	535.3		
07-083-WR2B		30364	1263.6 *	265.15 *	197.4 *		20439	306.47 *			1063.7		
07-083-WR3		26332	52198	2371.3			44695	774.29 *			584.39		
07-083-WR4A		26695	1444.6	259.98 *	186.58 *		19168			96.032 *	2037.7		
07-083-WR4A-DUP		27456	1626.8		228.19 *		18801	290.71 *		91.83 *	1742.4		
07-083-WR4B		31695	1557.8	330.69 *	233.82 *		18529	434.43 *		160.63 *	274.66		
07-083-WR1-COMP		32512	1216.7 *	507.65 *	221.52 *		16199	327.52 *		80.27 *	883.8		

XRF SAMPLE I.D.	Sr	Zr	Mo	Hg	Pb	Rb	Cd	Sn	Sb	Ba	Ag	U	Th
07-083-WR1A	16.947 *	95.993			4312.6	197.14			115.93 *	189.44	142.27 *	68.071	74.925
07-083-WR1B	42.581	128.58	9.1815 *		1546.4	240.64				537.3	121.43 *	63.254 *	84.938
07-083-WR2A	14.889 *	100.73	16.262 *		2115	187.95				196.45	91.258 *	68.543	73.755
07-083-WR2B		72.836			1146.6	189.68				145.87	96.283 *	78.344	87.454
07-083-WR3	83.485	116.1			3062.4	185.24				217.04	174.94 *		
07-083-WR4A	10.133 *	68.35			3143.1	179.77			295.76	114.43	735.05	54.29 *	49.134 *
07-083-WR4A-DUP	7.2543 *	75.705			3185.5	188.25			321.42	125.37	727.85	52.122 *	63.035
07-083-WR4B		71.064			2143	171.25			130.08 *	115.28	225.94 *	64.764	57.53
07-083-WR1-COMP	19.672 *	85.694			2405.9	207.94			93.418 *	218.2	362.72	59.542 *	75.094

ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS) SCORESHEET

I.X.L./EUREKA
PA NO. 07-083

AIMSS SCORESHEET

SITE NAME: IXL/EUREKA
PA NUMBER: 07-083

GROUNDWATER PATHWAY

LINE NO.				
1	GW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A		CONTAINMENT		20
3B		GW DEPTH		20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	400
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	400
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	3.905
6	GW - TARGETS	WELLS - 1 MI. x 2.5		7.5
7		WELLS - 1 TO 4 MI		5
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	12.5
10		**GROUNDWATER SCORE**	LINES 4 x 5 x 9	19525

SURFACE WATER PATHWAY

11	SW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		300
12		EXCEEDENCES		0
13A		CONTAINMENT		20
13B		DISTANCE TO SW		20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	400
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	700
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	4.317
16	SW - TARGETS	DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		1
18		WETLANDS		10
19		FISHERY		5
20		RECREATION		5
21		IRRIGATION/STOCK		0
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 THRU 22	21
24		**SURFACE WATER SCORE**	LINES 14 x 15 x 23	63460

AIR PATHWAY

25	AIR - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
26A		CONTAINMENT		10
26B		DISTANCE TO POPULATION		5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	50
27		LIKELIHOOD SCORE	LINES 25 + 26C	50
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.357
29	AIR - TARGETS	POPULATION - 4 MILES		30
30		NEAREST RESIDENCE		0
31		WETLANDS		0
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 THRU 33	30
35		**AIR PATHWAY SCORE**	LINES 27 x 28 x 34	536

DIRECT CONTACT PATHWAY

36	LIKELIHOOD OF EXPOSURE	OBSERVED EXPOSURE		0
37A		ACCESSIBILITY		10
37B		DISTANCE TO POPULATION		5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	50
38		LIKELIHOOD SCORE	LINES 36 + 37C	50
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.325
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE		1
41		NEAREST RESIDENCE		0
42		RECREATIONAL USE		0
43		TARGETS SCORE	SUM LINES 40 THRU 42	1
44		**DIRECT CONTACT SCORE**	LINES 38 x 39 x 43	16

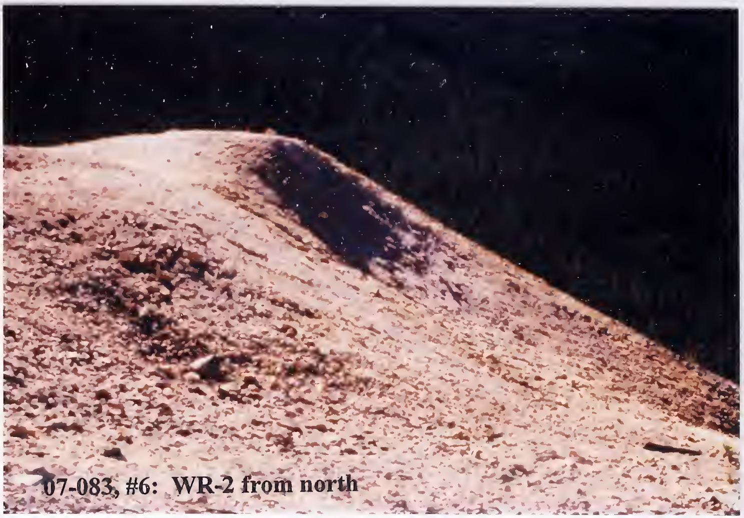
45	**TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE** (LINES 10 + 24 + 35 + 44) / 100,000	**0.84**

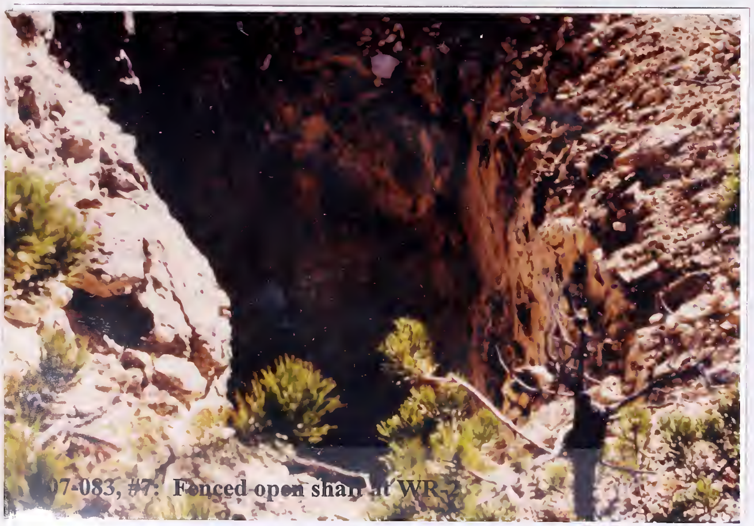
SITE NAME: IXL/EUREKA
PA NUMBER: 07-083

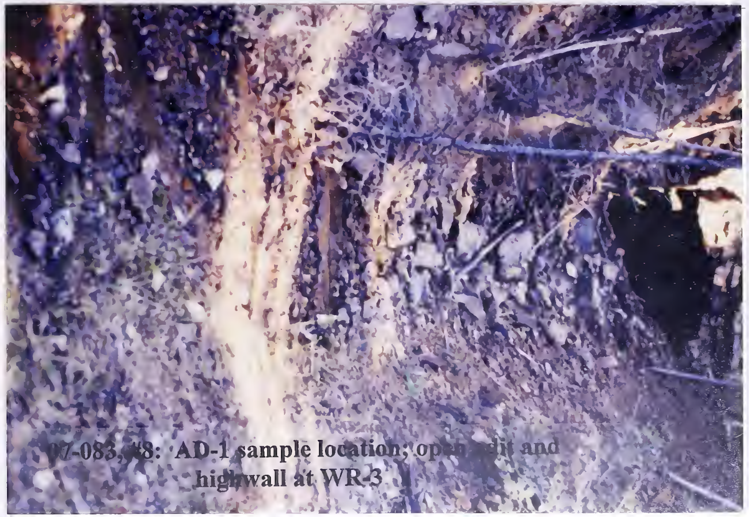
SITE SAFETY

LINE NO.				
1	THREAT	ACCESSIBILITY		10
2		OPEN SHAFTS	100 EA.	400
3		OPEN ADITS	50 EA.	150
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	150
5		HAZ. STRUCTURES	40 EA.	40
6		EXPLOSIVE HAZARD		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 THRU 7	740
9		POPULATION - 1 MILE		1
10	TARGETS	NEAREST RESIDENCE		0
11		RECREATIONAL USE		0
12		TARGETS SCORE	SUM LINES 9 THRU 11	1
13		**SITE SAFETY SCORE**	(LINES 1 x 8 x 12) / 1,000	**7.40**

, #5: W below


07-083, #6: WR-2 from north


07-083, #7: Fenced open shaft at WR-2


07-083, #8: AD-1 sample location; open adit and highwall at WR-3

[illegible], #5: W[illegible] below

07-083, #6: WR-2 from north

07-083, #7: Fenced-open shaft at WR-2

07-083, #8: AD-1 sample location; open adit and highwall at WR-3

07-083, #13: Open adit [illegible] WR-4

[illegible]

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY SITE INVESTIGATION LOG SHEET

Mine/Site Name: CORNUCOPIA **PA#:** 07-147

Date: September 25, 1995 **Time:** 1345-1800

Field Team Leader: Tuesday, Pioneer

Sampling Personnel: Flammang, Pioneer

Visitors: None

Weather/Seasonality Observations: Warm (50-60°F); sunny; calm; soil is frozen in shady areas; no rain for a week.

Photographic Log (Photo No.'s/Video Tape Number)**:** #1: Adit and highwall at WR-2; #2: WR-2 from west; #3: Deep erosion gully in WR-2; #4: Drainage away from WR-2 (Note: Waste rock in drainage); #5: Erosion gully off north face of WR-1; #23: WR-1 from west; #24: Erosion gully on north side of WR-1, looking down; #25: Collasped shaft at WR-1 (possibly open). Video Tape No. 1

General Comments/Observations (not covered specifically in attached Inventory Forms)**:** Site is in two distinct areas: upper part is associated with collapsed shaft; lower is in drainage and is associated with collapsed adit.

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Grade, cover, and revegetate upper dump. Move lower dump out of streambed and rehabilitate stream.

I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): CORNUCOPIA **PA#:** 07-147

Legal Description: **T** 14N **;R** 8E **;Sec.** 22 **,** SW **1/4** SE **1/4** ____ **1/4**

County: Cascade **Mining District:** Neihart

Latitude: N 46° 57' 17" **Longitude:** W 110° 41' 27"

Primary Drainage Basin and Code: Belt Creek/10030105
Secondary Drainage Basin: Snow Creek/Carpenter Creek
USGS Quadrangle map name(s): Neihart

Mine Type/Commodities: Hardrock/Silver, Lead, Zinc
Activity Status: Active ____**,Inactive/Exploration**____**,Abandoned** X **.**

Ownership status: Known Y X **N** ___**; private/public?** Private
Owner, Agent, or Contact (Include address and phone when available)**:** Paul Hatfield, Lexington Silver Lead Mines, Inc., Benton Group Mining Co., P.O. Box 323, Veradale, WA 99037.

Relationship to other mines/sites in the area/district: 1/4 mile north of Ontario, 1/2 mile northeast of Rebellion and Ripple Mines, 1/2 mile east of Black Diamond Jay

Regulatory Status (Activity by other agencies)? Hardrock permits? Past Reclamation Activities? Unknown

General site features: Elevation 6820'-7400'**, Slope** 30°**,**
Aspect North

Land use: Mining____**, Recreational** X **, Residential**____**, Urban**____**,**
Agricultural____**, Other(Specify)**____

Area of disturbed/unvegetated lands? 1.3 **acre(s).**
Site Dimensions: 230 feet x 200 feet (upper); 50 feet x 200 feet (lower)

Predominant vegetation types: Lodgepole pine, lupine, raspberries

Access: roads - good (paved)____**,poor (maintained dirt road)**____**,**
4wd X **,trail** X **.**
Other logistical considerations (proximity to other sites). Site is at the end of the road that leads to Ripple, Big Seven, Benton, and Ontario sites; locked gate on Snow Creek Road.

Well logs within 1 mile radius; (Attach MBMG Well Log Printout(s): There are 3 well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also note presence of radioactive minerals). The Cornucopia claim is one of a group of 12 patented claims on the the northeast slope of Long Baldy Mountain near the headwaters of the East Fork of Snow Creek about 3 miles southeast of Neihart. Site is underlain by Pinto diorite. Unnamed tributary of Snow Creek flows north to Snow Creek approximately 3,500 feet downstream. Snow Creek flows into Carpenter Creek 1.5 miles to the west. Carpenter Creek flows southwest approximately 2 miles to confluence with Belt Creek.

Mining/milling history, ore type/tenor, host rock, gangue: The vein at one adit is composed of about 12" of rusty quartz with about 2' of altered, banded Pinto diorite on each side. Elsewhere, the vein contained a stringer of sulfide minerals 1" to 6" in width. Dump material showed presence of oxides and carbonates, as well as galena, sphalerite, pyrite, and small amounts of chalcopyrite.

Mine Operation?

Shafts - **Yes** X, **No** ___, **#** 1, **Comment** Collapsed; shaft house has fallen into the hole.

Adits - **Yes** X, **No** ___, **#** 1, **Comment** Caved

Pits - **Yes** ___, **No** X, **#** ___, **Comment**

Placers - **Yes** ___, **No** X, **#** ___, **Comment**

Other - **Yes** ___, **No** X, **#** ___, **Comment**

Mill Operation? **Yes** ___, **No** X. **If yes answer the next three questions:**

Period(s) of Operation: N/A

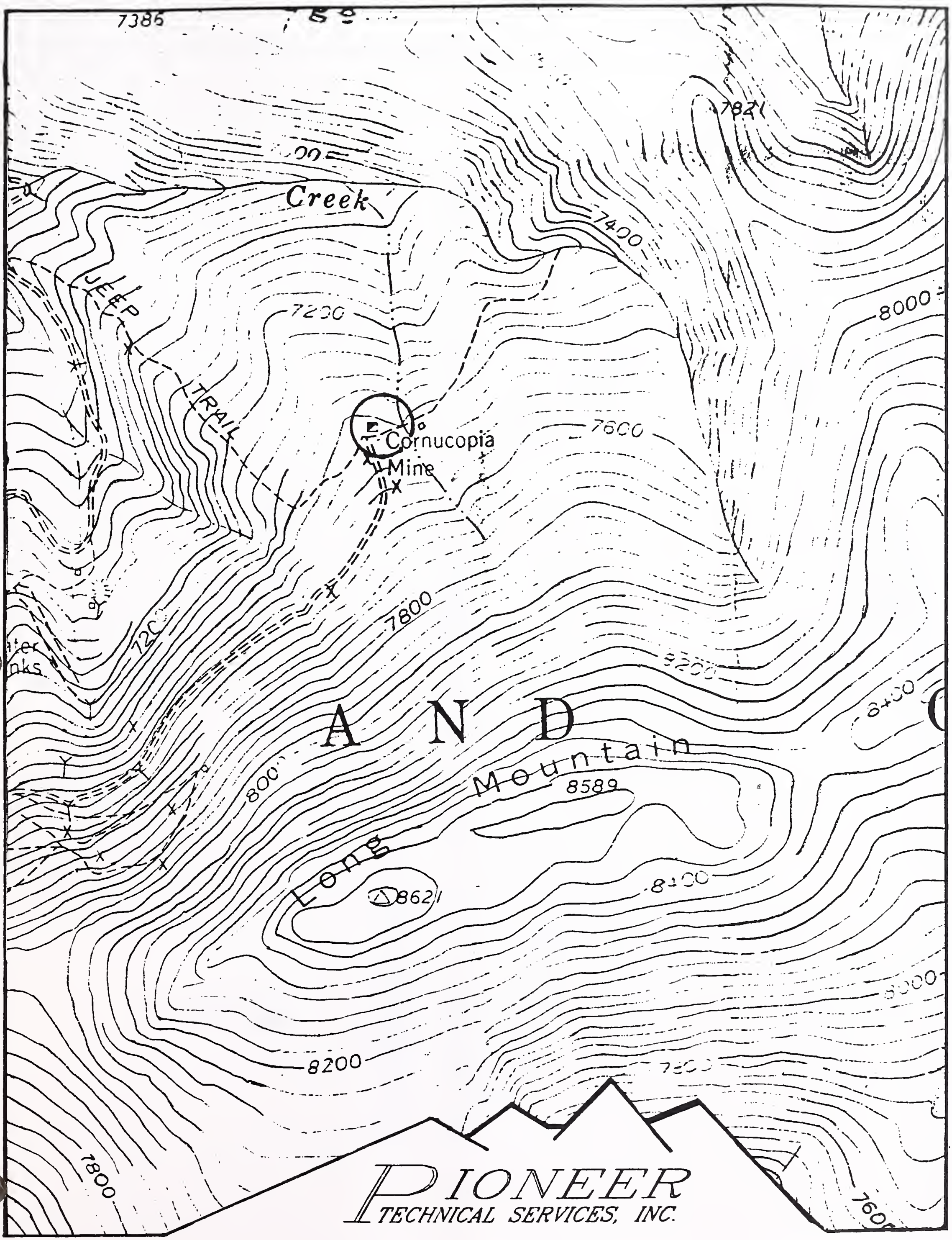
Origin of Ore Milled - Custom Mill___ **Dedicated Mill**___; **Number and names of mines that supplied mill feed:** N/A

Process? Hg-amalgam, CN$^-$ leach (vat, heap), floatation, smelting?
N/A

Montana Bureau of Mines and Geology
Water Well Log Data

10/22/1993

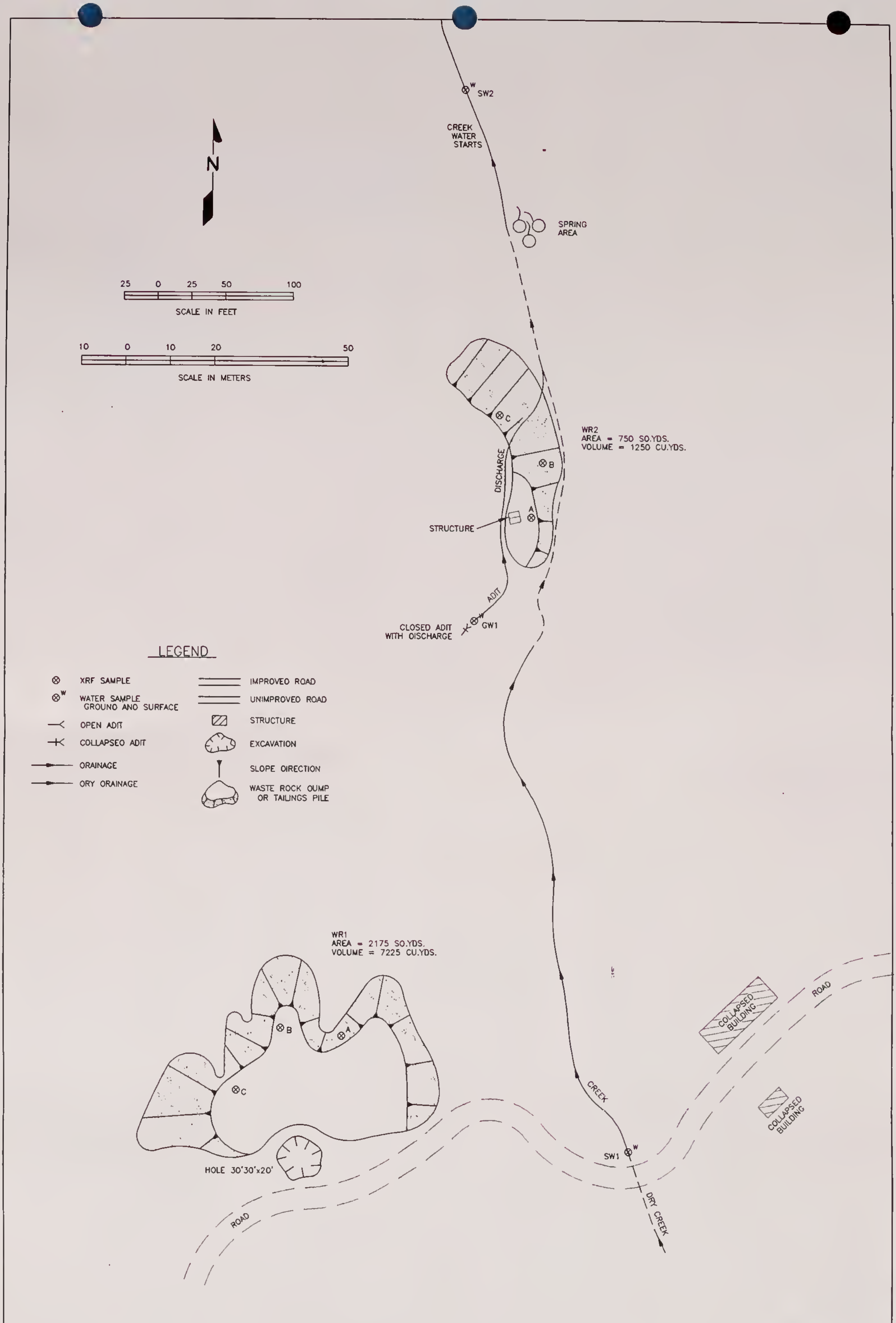
Well No.	Location	Depth	Yield	Static Water Level
M:123062	14N 08E 20 DBA	41.0	4.0	24.00
M:123061	14N 08E 20 DBA	40.0	7.0	0.00
M:25649	14N 08E 32 BDC	120.0	8.0	7.00



CORNUCOPIA, P.A. NO. 07-147

T14N, R08E, SECTION 22

SCALE: 1" = 1000'



GPS FILE CREATED 9/25/95

DRAWN FOR:

PIONEER TECHNICAL SERVICES, INC.
P.O. BOX 3445
BUTTE, MT 59702

TITLE:

CORNUCOPIA
PA# 07-147

DRAWING NO.: PT342114
DATE: 3/5/96
PLOT SCALE: 1 = 20

II. INFORMATION COLLECTED ON SITE

A. SOLID MATRIX WASTE CHARACTERIZATION

1. **Waste Characteristics** - *Use table on following page.*

Unique source identification: (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TP); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures/vessels sound, are runon/runoff controls in place, are wastes covered or vegetated, pond liners intact?

2. **TAILINGS IMPOUNDMENTS** - *If tailings impoundments are also present, complete the following questions.*

Describe the tailings grain size distribution (approximate % sand, silt, & clay): N/A

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): N/A

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): N/A

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): N/A

Comments on potential for mitigation: N/A

SOURCE INVENTORY FORM

SAMPLERS: Tuesday, Flammang

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd³)	LOCATION/DESCRIPTION	CONTAIN-MENT	pH SU (D/S)*	RADIO-ACTIVITY (mR/HR)	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
WR-1A	WR	7,225	Associated with shaft; east side, south end, on top	None	4.2	0.04	07-147-WR-1	09/26/95 1200	T-Metals, ABA
WR-1B	WR		Associated with shaft; west side, north face	None	4.8	0.05			
WR-1C	WR		Associated with shaft; west side, near west face, on top	None	5.6	0.04			
WR-2A	WR	1,250	Associated with collapsed adit; 15 feet northwest of sheet metal building, west slope of highest mound	None	6.6	0.06	07-147-WR-2	09/26/95 1200	T-Metals, ABA
WR-2B	WR		Associated with collapsed adit; northeast end of site, east face above creek	None	6.2	0.05			
WR-2C	WR		Associated with collapsed adit; northwest end of site, east face above adit discharge channel	None	5.6	0.06			

* pH readings were taken directly on-site (Kelwey Meter).

Comments or deviations from SOPs: 07-147-WR-1 is a composite of WR-1A through -1C. 07-147-WR-2 is a composite of WR-2A through -2C. Background sample was collected at the Ripple Mine (07-163-SS-1) during the 1994 investigation.

B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes_X_, No_____, Number:_1___ Identification:__GW-1 associated with WR-2; MDEQ/ERD sample CC-GW-7

Filled shafts: Yes___, No_X_, Number:____ Identification:________

Seeps/Springs: Yes_X_, No___, Number:____ Identification:_Several lower in drainage

Groundwater wells within 4 miles?: Yes_X_, No___;
Number of well logs:_13___

Distance to nearest well used for drinking:
___<1,000 ft;___1,000 ft to 0.5 miles;_X_>0.5 miles.

Sample types: Flowing adits (AD); filled shafts (SH); Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?
Definite____, **Probable**____, **Possible**_X__, **Unlikely**____.
Elevated metal values in uncontained source in drainage.

Approximate Depth to Groundwater:_X_<25 ft;___ 25 - 100 ft;___ >100 ft.

Other observations/notes:__Groundwater is <25 feet at lower site.

GROUNDWATER INVENTORY FORM

SAMPLERS: Tuesday, Flammang, Babits

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SOURCE	FLOW* cfs/gpm	pH SU	SC $\mu S/cm$ @ 25°C	Eh mV	Temp °C	ALK. mg/L as $CaCO_3$	Depth ft	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
GW-1	AD	Collapsed adit	10 gpm (E)	7.99	158	NM	7.0	NM	N/A	CC-GW-7	08/01/95 1045	T-Metals

FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): Sample was taken during a site investigation for MDEQ/Environmental Remediation Division/CERCLA Program. Flow from adit during this investigation immediately split into two distinct directions with very low flow in both (approximately 2 gpm combined); no good sampling point.

C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/run-off) and directions on sketch maps.

Flowing streams: Yes X , No____, Name(s): Unnamed tributary to Snow Creek; stream was flowing adjacent to WR-1, then dried up, did not flow through WR-2 area, and resurfaced 175 feet below WR-2.

Dry streambeds: Yes X , No____, Name(s): Unnamed tributary to Snow Creek

Other surface water: Yes X , No____, Name(s)/Description: Adit discharge

Waste materials within any floodplain: Yes X , No____ Source ID(s): WR-2

Approximate Flood frequency? X 1 yr, ___10 yr, ___100 yr

Estimated seasonal flow of stream(s) (cfs/gpm)? 0-5 gpm
High Flow: 50 gpm , **Average Flow:** 0-5 gpm

Distance between waste source(s) and nearest surface water body (ft)? 0 feet - adit discharge flows over and cuts through WR-2; 0 feet - unnamed tributary when flowing cuts WR-2; and 80 feet - WR-1 and unnamed tributary.

Surface water draining onto or through waste sources: Yes X , No____,
Describe: Adit discharge and unnamed tributary (when flowing)

Surface water use within 15 miles downstream? **(Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)**
Residential, wetlands, fishery (Belt Creek)

Observed erosional/sedimentation/stream turbidity problems? Yes X , No_____. **Distance downstream (ft)?** 0-500___; 500-1,000___; >1,000 X .
Describe/explain **(Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present):** Waste rock present in creek through at least 1,000 feet (visual). Sediments from 500 feet and 950 feet show elevated metal values. Banks are very eroded, oversteepened where stream cuts through WR-2.

SURFACE WATER INVENTORY FORM

SAMPLERS: Tuesday, Flammang

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SAMPLE LOCATION	pH SU	SC $\mu S/cm$ @ 25°C	Temp °C	ALK. mg/L as $CaCO_3$	Flow* cfs/gpm	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
SW-1	SW	20' below road	8.7	53	3.6	16	5 gpm (E)	07-147-SW-1	09/25/95 1510	T-Metals, TDS, Hardness, Cl, SO4
SE-1	SE	20' below road	N/A	N/A	N/A	N/A	N/A	07-147-SE-1	09/25/95 1510	T-Metals
SW-2	SW	175' below base of WR-2 where stream reappears	8.3	61	4.2	11	5 gpm (E)	07-147-SW-2	09/25/95 1700	T-Metals, TDS, Hardness, Cl, SO4
SE-2	SE	175' below base of WR-2 where stream reappears	N/A	N/A	N/A	N/A	N/A	07-147-SE-2	09/25/95 1700	T-Metals
SE-500	SE	500' downstream of SE-2	N/A	N/A	N/A	N/A	N/A	N/a	N/A	XRF Analysis
SE-1000	SE	950' downstream of SE-2; 10' upstream of where another tributary comes in	N/A	N/A	N/A	N/A	N/A	N/A	N/A	XRF Analysis

*FLOW: Estimated (E) or Measured (M)?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): ____________

D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

AMD Characteristics:

Presence and abundance of sulfides?	*(SO_3)*
Presence of evaporative salt deposits?	*(ESD)*
Discolored or turbid seepage?	*(SPG)*
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	*(FEOX)*
Presence of burned or stressed vegetation?	*(VEG)*
pH ≤ 5.0	*(pH)*

General Potential for AMD Mitigation:

Area available for treatment (acres)? None

Wetlands present: Yes___, No X, Describe:

Carbonate rocks/soils: Yes___, No X, Describe:

E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10___; 10-30___; 30-100 X; 100-300___; 300-1,000___; 1,000-3,000___; 3,000-10,000___; 10,000 or greater___; Comments

Nearest residence:___<1,000 ft;___1,000 ft - 0.5 miles; X >0.5 miles.

For each source (table next page):

Available fine materials? Surface area?

Uncovered and unvegetated? Wet or dry?

Overall dust propagation potential:
observed high moderate low none

ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

SAMPLERS: Tuesday, Flammang

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LIST)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/HIGH/MODERATE/LOW/NONE)
WR-1	pH; FEOX	Dry	19,575	18,595	Yes	Low
WR-2	FEOX	Partial	6,750	4,625	Yes	Low
AD-1	FEOX	N/A	N/A	N/A	N/A	N/A

Notes and Clarifications: ______

F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes____, No_X_
Describe:____

Population within 1 mile: 1-10_X_; 10-30___; 30-100___; 100-300___; 300-1,000___; 1,000-3,000___; 3,000-10,000___; 10,000 or greater___;
Comments____

Evidence of recreational use on site: Yes___, No_X_, Describe:_______

Accessibility (check each that apply):___Easily accessible - no fences, gates, or warning signs;_X_Moderately Accessible - barbed wire fences, road gated, or signs posted;___Difficult Access - chain-link fence, road gated and locked, site guarded (does not include locked or manned access points located more than 0.5 miles from the actual site).

Sensitive environments on-site or adjacent to site:
State or National Parks - Yes___, No_X_, Comment________________
Wilderness Area - Yes___, No_X_, Comment________________
T&E Species Habitat - Yes___, No_X_, Comment________________
Bat Habitat - Yes___, No_X_, Comment________________

Primary Drainage_X_; Secondary Drainage___; No Information___:
Riparian Habitat Quality - High___, Medium_X_, Low___
Wetlands Frontage - High___, Medium___, Low_X_
Fisheries Habitat and Species Classification - _3_
Sport Fishery Classification - _3_

G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes___, No_X_, Number____, types and locations:___
Hazardous structures: Yes_X_, No___, Number_2_, types and locations:_ Buildings partially collapsed east of WR-1
Unstable highwalls, pits, trenches, slopes: Yes_X_, No___, Number_2_, types and locations:_ Large pit (30' x 30' x 15') associated with collapsed shaft with junk in bottom; collapsed adit has 25' highwall, which is undercaving.
Unstable waste piles, impoundments, undercut banks: Yes_X_, No____, Number_2_, types and locations:_ WR-2 is oversteepened and undercut on both the creek side and along adit discharge channel; WR-1 is steep, at angle of repose, and has erosion channels with waste rock 180' downslope.
Fire and/or Explosion hazards: Yes___, No_X_, Explain:________________
____

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MDEQ/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for Cornucopia Mine, Prepared by Chen-Northern, October 18, 1989.

MDEQ/AMRB Files, Hazardous Materials Inventory Site Investigation Log Sheet for Big Seven, Prepared by Pioneer Technical Services, Inc., May 27, 1993.

MDEQ/ERD Files, Final Preliminary Assessment/Site Inspection Report for the Carpenter and Snow Creek Mining Complex Site, Neihart, Montana, Prepared by Pioneer Technical Services, Inc., December 1995.

USBM, Mines and Mineral Deposits (Except Fuels), Cascade County, Montana, Information Circular No. 7589, Written by Almon F. Robertson, April 1950.

USGS, Topographic Map, Neihart, Montana, 7 1/2 minute Quadrangle, 1961.

LABORATORY ANALYTICAL DATA

CORNUCOPIA
PA NO. 07-147

Cornucopia PA# 07-147
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/25/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
07-147-SE-1	5.4 UJ	5.77	46.1 J	1.4 J	2570	16.0	12.4	15.5 JX	23000	30.0	4860	492	0.043 U	14.7	0.8 U	102	NR
07-147-SE-2	6.3 UJ	35.8	57.8 J	2.3 J	2370.0	8.9	6.8	17.9 JX	20300	124	1980	365	0.050 U	6.7	8.0	228	NR
07-147-WR-1	5.9 UJ	184	78.2 J	3.1 J	947	5.2	4.3	28.4 JX	49600	723	1890	163	0.33	5.4	58.8	559	NR
07-147-WR-2	5.7 UJ	58.9	53.0 J	2.2 J	2460	11.7	5.0	25.9 JX	23900	194	1770	278	0.22	8.2	4.6	217	NR
BACKGROUND	4.7 UJ	9.6	87.6	1.32 JX	NR	27.2 J	9.05 J	10.8 J	21100	52.4 JX	NR	708 J	0.04	10.3	0.5 B	135	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
07-147-WR-1	0.26	8.12	-3.88	-12.0	0.24	<0.01	0.02	0.00	-3.88	-3.88	-8.15	6.25	-12.66	-26.59
07-147-WR-2	0.10	3.12	1.37	-1.76	0.05	0.05	<0.01	1.56	-0.19	-0.19	-0.40	2.73	-1.71	-3.58

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
07-147-SW-1	2.7 U	1.8 U	24.2	7.5	22700	9.6 U	10.9 U	4.4 U	29.2	1.8 JX	7780	18.0 J	0.16 U	13.9 U	0.21 UJX	2450	88.8
07-147-SW-2	2.7 U	2.0	11.8	4.4	11700	9.6 U	10.9 U	4.4 U	32.8	2.2 JX	3800	5.2 UJ	0.16 U	13.9 U	0.45 JX	1150	44.8
CC-GW-7	45.9 U	2.3 U	12	3.1 U	14800	2.8 U	4.3 U	16.4	1290.0	11.7	4620	111	0.1 U	14.2 U	2.20 U	107	56.0

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
07-147-SW-1	98	< 5	77	NR	NR
07-147-SW-2	46	< 5	36	NR	NR

Legend

SE-1- 20' below road.
SE-2- 175' below base of WR2 where stream reappears.
WR-1- Composite WR1A, 1B, 1C.
WR-2- Composite WR2A, 2B, 2C.
BACKGROUND- From the Ripple (07-163-SS1) (1994 data).
SW-1- Same as SE-1.
SW-2- Same as SE-2.
CC-GW-7- Adit discharge (GW1 on sketch)

XRF ANALYSIS RESULTS

CORNUCOPIA
PA NO. 07-147

Mine Name: Cornucopia PA No. 07-147
XRF Field Analyses
Results in PPM

XRF SAMPLE I.D.	CrHI	K	Ca	TI	CrLO	Mn	Fe	Co	Ni	Cu	Zn	As	Se
07-147-WR1A		21376	3549.2	4492			77136	910.61 *			368.56	181.05 *	
07-147-WR1B		17006	5138.9	5724.4			53960				231.48	140.44 *	
07-147-WR1C		22326	4914.9	5335.9			76863	995.64 *			982.9		
07-147-WR1C-SDUP	522.88 *	17920	3883.2	4705.5			75196	900.69 *		77.002 *	952.11		
07-147-WR2A		12494	12210	4790.3		1639.6 *	34158	752.7 *			444.81		
07-147-WR2B		17875	5299.2	5229.3			51479	789.39 *			254.26	113.25 *	
07-147-WR2C		16165	7198.6	6802.8			41329	720.1 *			176.84 *		
07-147-SED-500		11727	6302.1	2501.4		844.74 *	26572	533.34 *			347.21		
07-147-SED-1000		12057	7729.6	3026.6		1199.7 *	32868	664.78 *			425.45		
07-147-WR1-COMP		16907	3683.1	4056.8		555.16 *	66826	778.67 *			432.31	120.45 *	
07-147-WR2-COMP		14466	6381.9	5150.4		593.75 *	38735				220.77 *	89.193 *	

XRF SAMPLE I.D.	Sr	Zr	Mo	Hg	Pb	Rb	Cd	Sn	Sb	Ba	Ag	U	Th
07-147-WR1A	252.14	279.54			532.96	140.46				1339.3	238.32 *		11.396 *
07-147-WR1B	314.7	307.52	8.0115 *		386.04	99.381				1084.4	131.9 *	15.402 *	15.36 *
07-147-WR1C	218.92	322.09			1131.6	112.82				871.6	147.06 *		
07-147-WR1C-SDUP	226.04	274.35			1005.4	118.02				861.55	156.63 *		
07-147-WR2A	445.77	170.11			98.952 *	60.763 *				682.94		28.589 *	22.433 *
07-147-WR2B	316.17	277.69	10.54 *		369.35	117.59				823.34			15.945 *
07-147-WR2C	266.31	414.31	9.214 *		283.71	117.69				958.22	136.65 *	19.812 *	20.471 *
07-147-SED-500	341.2	335.48			91.472 *	117.76				743.27	87.39 *	20.412 *	19.794 *
07-147-SED-1000	310.61	466.85			140.19	102.52				1111.9	128.06 *	21.465 *	23.281 *
07-147-WR1-COMP	246.85	298.77			701.54	111.55				1119.7	154.51 *	13.757 *	11.548 *
07-147-WR2-COMP	340.95	289.65			204.37	102.26				830.49	104.82 *	18.316 *	22.892 *

ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS) SCORESHEET

CORNUCOPIA
PA NO. 07-147

AIMSS SCORESHEET

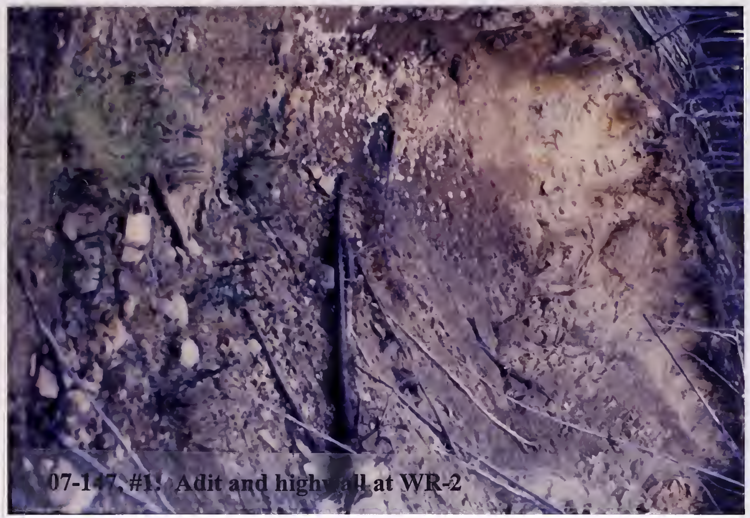
SITE NAME: CORNUCOPIA
PA NUMBER: 07-147

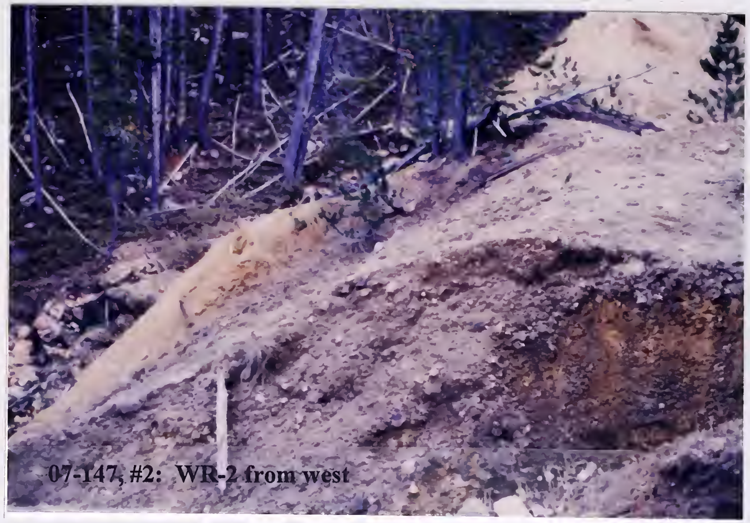
LINE NO.				
		GROUNDWATER PATHWAY		
1	GW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A		CONTAINMENT		20
3B		GW DEPTH		20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	400
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	400
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	3.907
6	GW - TARGETS	WELLS - 1 MI. x 2.5		7.5
7		WELLS - 1 TO 4 MI		10
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	17.5
10		**GROUNDWATER SCORE**	LINES 4 x 5 x 9	27349
		SURFACE WATER PATHWAY		
11	SW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		300
12		EXCEEDENCES		100
13A		CONTAINMENT		20
13B		DISTANCE TO SW		20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	400
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	800
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	4.310
16	SW - TARGETS	DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		1
18		WETLANDS		10
19		FISHERY		5
20		RECREATION		5
21		IRRIGATION/STOCK		0
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 THRU 22	21
24		**SURFACE WATER SCORE**	LINES 14 x 15 x 23	72408
		AIR PATHWAY		
25	AIR - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
26A		CONTAINMENT		10
26B		DISTANCE TO POPULATION		5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	50
27		LIKELIHOOD SCORE	LINES 25 + 26C	50
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.097
29	AIR - TARGETS	POPULATION - 4 MILES		30
30		NEAREST RESIDENCE		0
31		WETLANDS		0
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 THRU 33	30
35		**AIR PATHWAY SCORE**	LINES 27 x 28 x 34	146
		DIRECT CONTACT PATHWAY		
36	LIKELIHOOD OF EXPOSURE	OBSERVED EXPOSURE		50
37A		ACCESSIBILITY		10
37B		DISTANCE TO POPULATION		5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	50
38		LIKELIHOOD SCORE	LINES 36 + 37C	100
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.087
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE		1
41		NEAREST RESIDENCE		0
42		RECREATIONAL USE		2
43		TARGETS SCORE	SUM LINES 40 THRU 42	3
44		**DIRECT CONTACT SCORE**	LINES 38 x 39 x 43	26
45	**TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE** (LINES 10 + 24 + 35 + 44) / 100,000			**1.00**

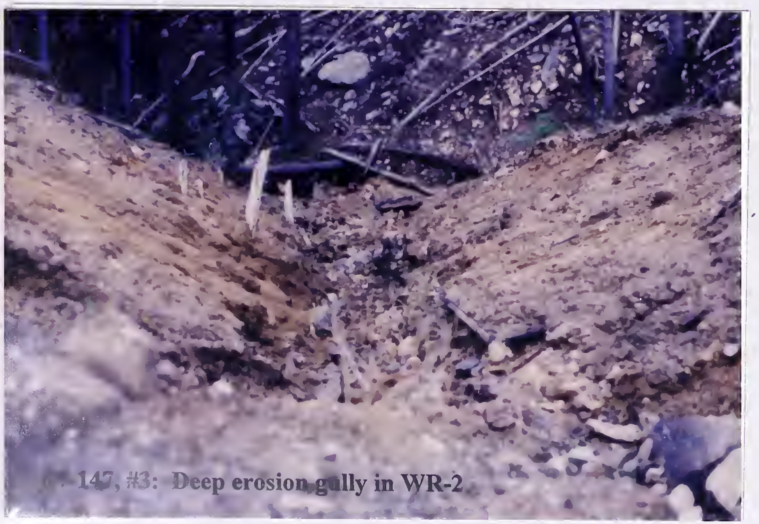
SITE NAME: CORNUCOPIA
PA NUMBER: 07-147

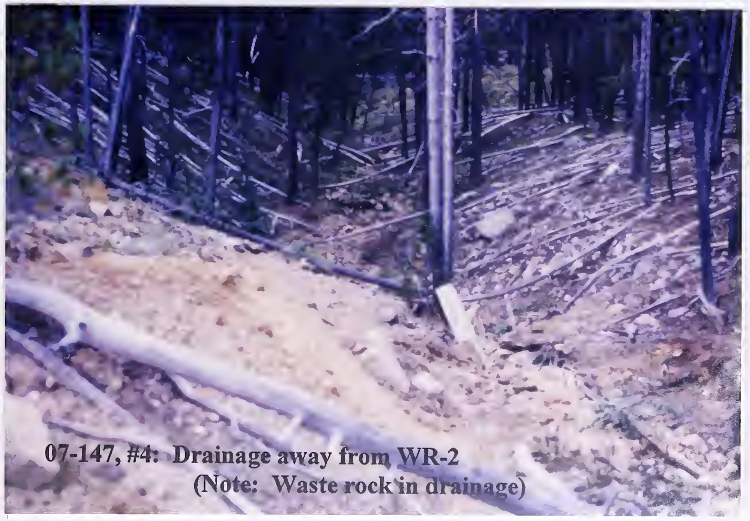
SITE SAFETY

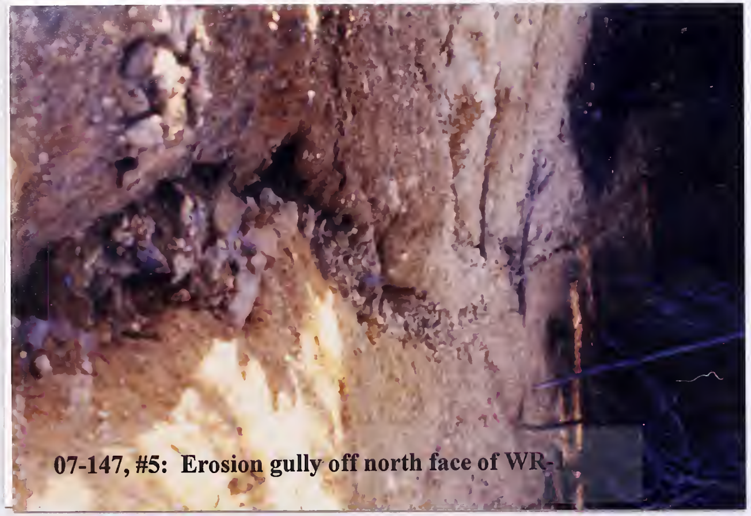
LINE NO.				
1	THREAT	ACCESSIBILITY		10
2		OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	0
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	150
5		HAZ. STRUCTURES	40 EA.	80
6		EXPLOSIVE HAZARD		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 THRU 7	230
9		POPULATION - 1 MILE		1
10	TARGETS	NEAREST RESIDENCE		0
11		RECREATIONAL USE		2
12		TARGETS SCORE	SUM LINES 9 THRU 11	3
13		**SITE SAFETY SCORE**	(LINES 1 x 8 x 12) / 1,000	**6.90**


07-147, #1: Adit and highwall at WR-2


07-147, #2: WR-2 from west


07-147, #3: Deep erosion gully in WR-2

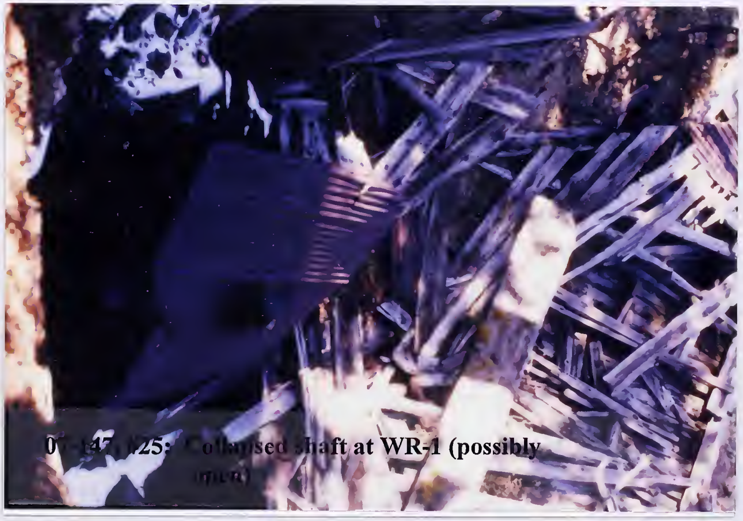

07-147, #4: Drainage away from WR-2
(Note: Waste rock in drainage)



07-147, #5: Erosion gully off north face of WR-1

07-147, #23: WR-1 from west

07-147, #24: Erosion gully on WR-1 (north side, looking down)



07-147, #25: Collapsed shaft at WR-1 (possibly open)

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY
SITE INVESTIGATION LOG SHEET

Mine/Site Name: ONTARIO **PA#:** 07-148

Date: September 25, 1995 **Time:** 1220-1330

Field Team Leader: Tuesday, Pioneer

Sampling Personnel: Flammang, Pioneer

Visitors: None

Weather/Seasonality Observations: Cool (40°F); clear; sunny.

Photographic Log (Photo No.'s/Video Tape Number)**:** #21: Collapsed adit (AD-1 sample location) and highwall; #22: WR-1 from road (north). Video Tape No. 1

General Comments/Observations (not covered specifically in attached Inventory Forms)**:** Adit discharge has ice on it near mouth. There are several dead trees at the base of WR-1.

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Route adit discharge around and away from waste rock dump; grade, cover, and revegetate dump. May possibly have to treat discharge.

I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): ONTARIO **PA#:** 07-148

Legal Description: T 14N ;R 8E ;Sec. 27 , NW 1/4 NE 1/4 ___ 1/4

County: CASCADE **Mining District:** NEIHART

Latitude: N 46° 57' 00" **Longitude:** W 110° 41' 32"

Primary Drainage Basin and Code: Belt Creek/10030105
Secondary Drainage Basin: Snow Creek/Carpenter Creek

USGS Quadrangle map name(s): Neihart

Mine Type/Commodities: Hardrock/Silver, Lead, Zinc
Activity Status: Active ___, Inactive/Exploration ___, Abandoned X .

Ownership status: Known Y X N ___; private/public? Private
Owner, Agent, or Contact (Include address and phone when available): Paul Hatfield, Lexington Silver Lead Mines, Inc., Benton Group Mining Co., P.O. Box 323, Veradale, WA 99037.

Relationship to other mines/sites in the area/district: 0.25 mile southwest of Cornucopia; 0.5 mile northeast of Ripple Mines.

Regulatory Status (Activity by other agencies)? Hardrock permits? Past Reclamation Activities? Unknown

General site features: Elevation 7600', Slope 30°, Aspect Northwest

Land use: Mining X , Recreational X , Residential ___, Urban ___, Agricultural ___, Other(Specify) ___

Area of disturbed/unvegetated lands? 0.45 acre(s).
Site Dimensions: 140 feet x 140 feet

Predominant vegetation types: Lodgepole and Limber pines, spruce, lupine, and bunchgrass

Access: roads - good (paved) ___, poor (maintained dirt road) ___, 4wd X , trail ___.
Other logistical considerations (proximity to other sites). Near Cornucopia; locked gate on access road up Snow Creek.

Well logs within 1 mile radius; (Attach MBMG Well Log Printout(s): There are 3 well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also note presence of radioactive minerals). Above unnamed tributary to Snow Creek. Unnamed tributary starts 1/4 mile northwest below the site, flows northwest 1/3 mile to confluence with another tributary, and continues flowing northwest 1/2 mile to confluence with Snow Creek. Snow Creek flows west approximately 1 mile to confluence with Carpenter Creek, which flows southwest to confluence with Belt Creek 1.5 miles.

Mining/milling history, ore type/tenor, host rock, gangue: No information was found.

Mine Operation?

Shafts - **Yes**___, **No** X , **#** ____, **Comment**

Adits - **Yes** X , **No**___, **#** 1 , **Comment** Caved, discharging

Pits - **Yes**___, **No** X , **#** ____, **Comment**

Placers - **Yes**___, **No** X , **#** ____, **Comment**

Other - **Yes**___, **No** X , **#** ____, **Comment**

Mill Operation? **Yes**____, **No** X . **If yes answer the next three questions:**

Period(s) of Operation: N/A

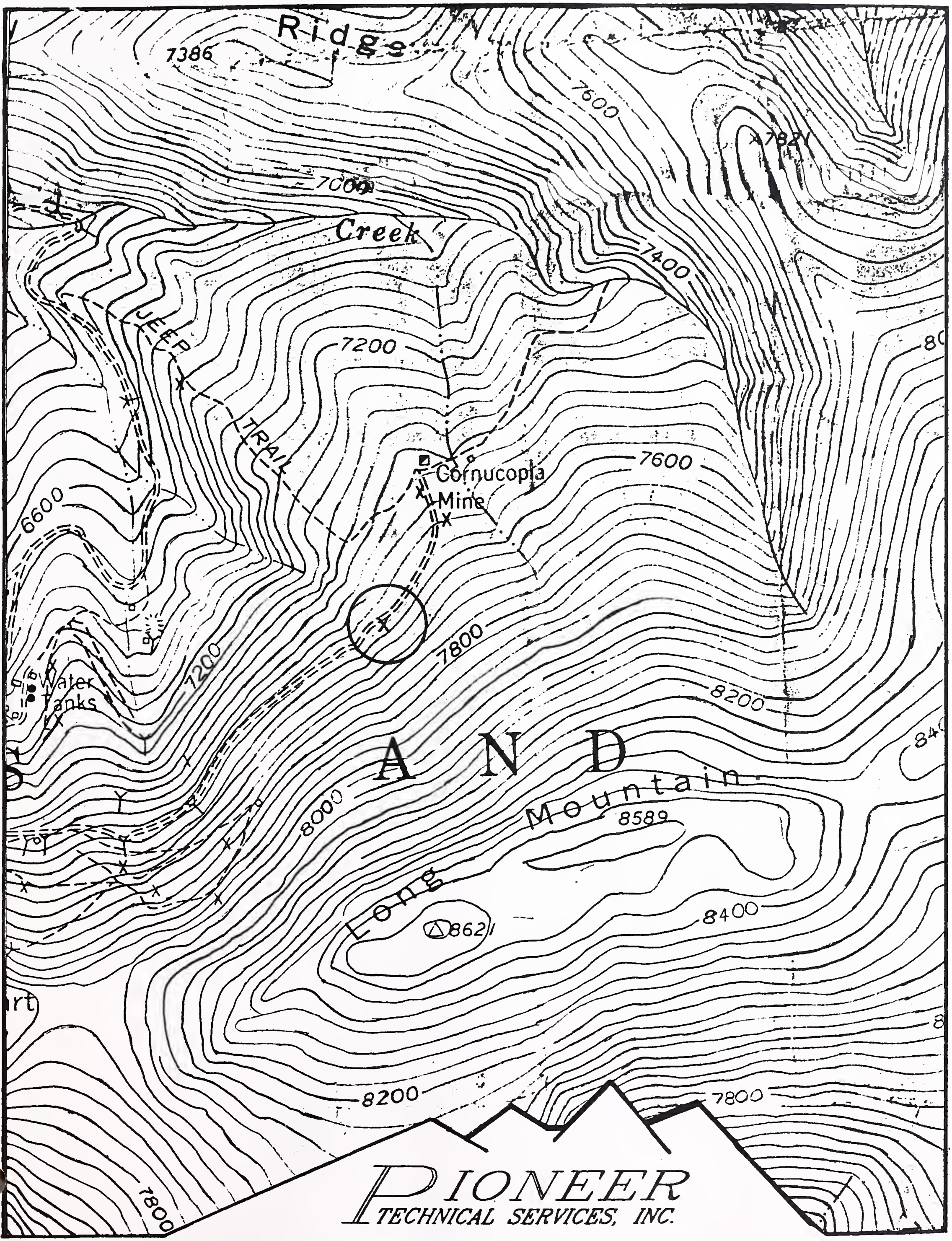
Origin of Ore Milled - Custom Mill___ Dedicated Mill___; Number and names of mines that supplied mill feed: N/A

Process? Hg-amalgam, CN⁻ leach (vat, heap), floatation, smelting? N/A

Montana Bureau of Mines and Geology
Water Well Log Data

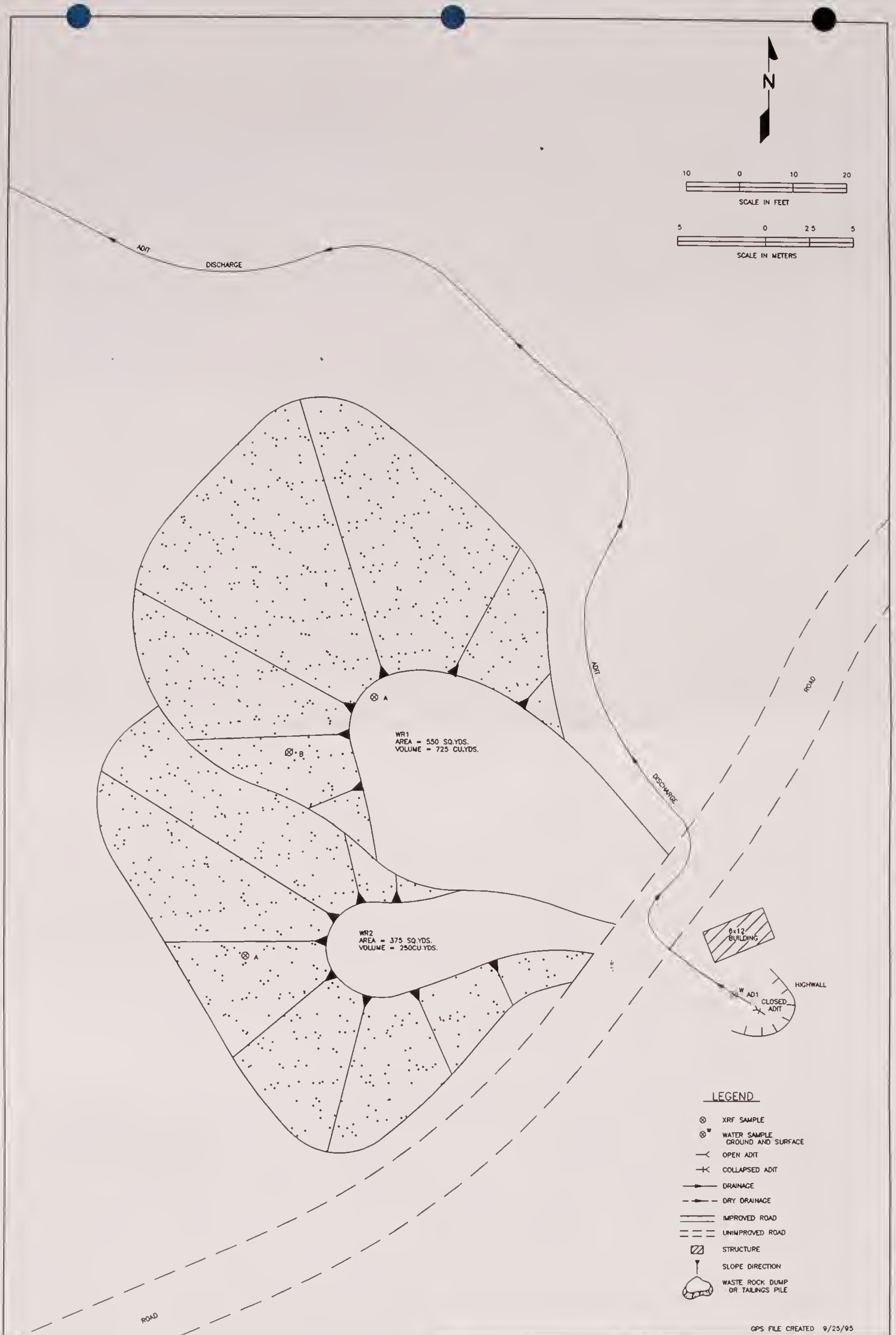
10/22/1993

ell No.	Location	Depth	Yield	Static Water Level
.123062	14N 08E 20 DBA	41.0	4.0	24.00
:123061	14N 08E 20 DBA	40.0	7.0	0.00
:25649	14N 08E 32 BDC	120.0	8.0	7.00



PIONEER
TECHNICAL SERVICES, INC.

ONTARIO, P.A. NO. 07-148
T14N, R08E, SECTION 27
SCALE 1" = 1000'



GPS FILE CREATED 9/25/95

DRAWN FOR:

PIONEER
TECHNICAL SERVICES, INC.
P.O. BOX 3445
BUTTE, MT 59702

TITLE:

ONTARIO
PA# 07-148

DRAWING NO.: PT342108
DATE: 1/30/96 PLOT SCALE: 1 = 5

II. INFORMATION COLLECTED ON SITE

A. SOLID MATRIX WASTE CHARACTERIZATION

1. **Waste Characteristics** - *Use table on following page.*

Unique source identification: (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TP); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures/vessels sound, are runon/runoff controls in place, are wastes covered or vegetated, pond liners intact?

2. **TAILINGS IMPOUNDMENTS** - *If tailings impoundments are also present, complete the following questions.*

Describe the tailings grain size distribution (approximate % sand, silt, & clay): N/A

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): N/A

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): N/A

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): N/A

Comments on potential for mitigation: N/A

SOURCE INVENTORY FORM

SAMPLERS: Flammang

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd^3)	LOCATION/DESCRIPTION	CONTAIN-MENT	pH SU (D/S)*	RADIO-ACTIVITY (mR/HR)	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
WR-1A	WR	725	Northwest side of dump	None	4.7	0.06	07-148-WR-1	09/25/95 1915	T-Metals, ABA
WR-1B	WR		Southwest side of dump	None	5.1	0.05			
WR-2	SOIL	250	Far west pile (not waste rock); appears to be push out for road	None	6.7	0.04	N/A	N/A	XRF Analysis

* pH readings were taken directly on-site (Kelway Meter).

Comments or deviations from SOPs: 07-148-WR-1 is a composite of WR-1A and -1B. Background sample was collected at the Ripple Mine (07-163-SS-1) during the 1994 investigation.

B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes_X_, No___, Number:_1_ Identification:_AD-1_

Filled shafts: Yes___, No_X_, Number:___ Identification:___

Seeps/Springs: Yes___, No_X_, Number:___ Identification:___

Groundwater wells within 4 miles?: Yes_X_, No___;
Number of well logs:_13_

Distance to nearest well used for drinking:
___<1,000 ft;___1,000 ft to 0.5 miles;_X_>0.5 miles.

Sample types: Flowing adits (AD); filled shafts (SH); Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?
Definite___, **Probable**___, **Possible**_X_, **Unlikely**___.
Shallow groundwater; moderate pH and metals in uncontained sources.

Approximate Depth to Groundwater:_X_<25 ft;___ 25 - 100 ft;___ >100 ft.

Other observations/notes:_N/A_

ER

GROUNDWATER INVENTORY FORM

SAMPLERS: Tuesday

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SOURCE	FLOW* cfs/gpm	pH SU	SC µS/cm @ 25°C	Eh mV	Temp °C	ALK. mg/L as $CaCO_3$	Depth ft	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
AD-1	AD	Adit discharge above road and WR-1	<1 gpm (E)	6.5	66	151.5	1.9	13	N/A	07-148-AD-1	09/25/95 1230	T-Metals, TDS, Hardness, Cl, SO4

FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?

Comments or Deviations from the SOPs *(Pioneer SAP, 1993): ________________________

C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/run-off) and directions on sketch maps.

Flowing streams: Yes____, No X , Name(s):

Dry streambeds: Yes____, No X , Name(s):

Other surface water: Yes X , No____, Name(s)/Description: Adit discharge

Waste materials within any floodplain: Yes____, No X Source ID(s):

Approximate Flood frequency? ___1 yr, ___10 yr, ___100 yr

Estimated seasonal flow of stream(s) (cfs/gpm)? N/A

High Flow:____________, **Average Flow:**______________

Distance between waste source(s) and nearest surface water body (ft)? 200 feet

Surface water draining onto or through waste sources: Yes____, No X ,

Describe: Discharge flows around dump.

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)

Wetlands, fishery (Belt Creek)

Observed erosional/sedimentation/stream turbidity problems? Yes_____, No X . **Distance downstream (ft)?** 0-500___; 500-1,000___; >1,000___.

Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present):

SURFACE WATER INVENTORY FORM

SAMPLERS: ____

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SAMPLE LOCATION	pH SU	SC $\mu S/cm$ @ 25°C	Temp °C	ALK. mg/L as $CaCO_3$	Flow* cfs/gpm	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
No samples were taken.										

FLOW: Estimated (E) or Measured (M)?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): ____

D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

AMD Characteristics:

Presence and abundance of sulfides?	*(SO_3)*
Presence of evaporative salt deposits?	*(ESD)*
Discolored or turbid seepage?	*(SPG)*
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	*(FEOX)*
Presence of burned or stressed vegetation?	*(VEG)*
pH ≤ 5.0	*(pH)*

General Potential for AMD Mitigation:

Area available for treatment (acres)? 1/2 acre, road and dump area

Wetlands present: Yes___, No X , Describe:

Carbonate rocks/soils: Yes___, No X , Describe:

E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10___; 10-30___; 30-100 X ; 100-300___; 300-1,000___; 1,000-3,000___; 3,000-10,000___; 10,000 or greater___; Comments

Nearest residence: ___<1,000 ft; ___1,000 ft - 0.5 miles; X >0.5 miles.

For each source (table next page):

Available fine materials? Surface area?

Uncovered and unvegetated? Wet or dry?

Overall dust propagation potential:
observed high moderate low none

ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

SAMPLERS: Tuesday, Flammang

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LIST)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/HIGH/MODERATE/LOW/NONE)
WR-1	FEOX	Dry	4,950	3,960	Yes	Low
AD-1	None	N/A	N/A	N/A	N/A	N/A
WR-2*	None	Dry	3,375	1,690	Yes	Low

Notes and Clarifications: *Appears to be dirt pushed out for road, not a source.

F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes_____, No__X__.
Describe:____

Population within 1 mile: 1-10__X__; 10-30___; 30-100___; 100-300___; 300-1,000____; 1,000-3,000____; 3,000-10,000____; 10,000 or greater____;
Comments____

Evidence of recreational use on site: Yes___, No__X__, Describe:________
____

Accessibility (check each that apply):___Easily accessible - no fences, gates, or warning signs;__X__Moderately Accessible - barbed wire fences, road gated, or signs posted;____Difficult Access - chain-link fence, road gated and locked, site guarded (does not include locked or manned access points located more than 0.5 miles from the actual site).

Sensitive environments on-site or adjacent to site:
State or National Parks - Yes____, No__X__, Comment____________________
Wilderness Area - Yes____, No__X__, Comment____________________
T&E Species Habitat - Yes____, No__X__, Comment____________________
Bat Habitat - Yes____, No__X__, Comment____________________

Primary Drainage____; Secondary Drainage__X__; No Information____:
Riparian Habitat Quality - High____, Medium__X__, Low____
Wetlands Frontage - High____, Medium____, Low__X__
Fisheries Habitat and Species Classification - __6__
Sport Fishery Classification - __6__

G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes____, No__X__, Number_____, types and locations:____
____

Hazardous structures: Yes__X__, No____, Number__1__, types and locations:_
Small shed on-site

Unstable highwalls, pits, trenches, slopes: Yes__X__, No____, Number__1__, types and locations:__Highwall at caved adit

Unstable waste piles, impoundments, undercut banks: Yes_____, No__X__, Number_____, types and locations:______________________________

Fire and/or Explosion hazards: Yes____, No__X__, Explain:______________
____

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MBMG, Geology and Ore Deposits of the Neihart Mining District, Cascade County, Montana, Memoir 13, Written by Paul A. Schafer, July 1935.

MBMG, Well Log Database, July 14, 1994.

MDFWP, Montana Rivers Information System Rivers Report, Prepared by Montana Natural Resource Information System, July 1995.

MDHES/SHWB, Superfund Basics, Overview and Accomplishments of Superfund in Montana 1983-1993, November 1993.

MDEQ/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for Ontario Mine, Prepared by Chen-Northern, October 18, 1989.

MDEQ/AMRB Files, Hazardous Materials Inventory Site Investigation Log Sheet for Big Seven, Prepared by Pioneer Technical Services, Inc., May 27, 1993.

USBM, Mines and Mineral Deposits (Except Fuels), Cascade County, Montana, Information Circular No. 7589, Written by Almon F. Robertson, April 1950.

USGS, Topographic Map, Neihart, Montana, 7 1/2 minute Quadrangle, 1961.

LABORATORY ANALYTICAL DATA

ONTARIO
PA NO. 07-148

Ontario PA# 07-148
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/25/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
07-148-WR-1	6.9 UJ	145	59.6 J	13.0 J	6380	19.1	25.5	35.4 JX	42100	347	2820	3090	0.15	52.9	1.2	948	NR
BACKGROUND	4.7 UJ	9.6	87.6	1.32 JX	NR	27.2 J	9.05 J	10.8 J	21100	52.4 JX	NR	708 J	0.04	10.3	0.5 B	135	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
07-148-WR-1	0.49	15.3	14.0	-1.33	0.03	0.20	0.26	6.25	7.73	7.73	16.23	15.08	-1.35	-2.83

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
07-148-AD-1	2.7 U	1.8 U	7.0	0.10	8360	9.6 U	10.9 U	4.4 U	139	1.3 UX	2540	19.1 J	0.16 U	13.9 U	1.4 JX	7.6 U	31.3

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
07-148-AD-1	12	< 5	< 5	NR	NR

Legend

WR-1- Composite WR1A and WR1B.
BACKGROUND- From the Ripple (07-163-SS1) (1994 data).
AD-1- Adit discharge above road and WR1.

XRF ANALYSIS RESULTS

ONTARIO
PA NO. 07-148

Mine Name: Ontario PA No. 07-148
XRF Field Analyses
Results in PPM

XRF SAMPLE I.D.	CrHI	K	Ca	TI	CrLO	Mn	Fe	Co	Ni	Cu	Zn	As	Se
07-148-WR1A		11941	8180.8	7222.6		3490	51203	788.49 *			519.81	138.4 *	
07-148-WR1B		10755	6348.3	5418		3553.3	48490	614.62 *			921.55		
07-148-WR2		18396	20912	4826.2		1062.1 *	42696	756.14 *			130.43 *		
07-148-WR1-COMP		11401	7138	6746	354.08 *	3806.1	50821	638.72 *			794.12	103.91 *	24.809 *

XRF SAMPLE I.D.	Sr	Zr	Mo	Hg	Pb	Rb	Cd	Sn	Sb	Ba	Ag	U	Th
07-148-WR1A	112.93	216.09			95.387 *	91.472				368.93	102.59 *	19.03 *	20.618 *
07-148-WR1B	89.622	574.64			417.28	82.257				734.74	139.12 *	19.922 *	14.158 *
07-148-WR2	604.36	200.44				81.61				1307.1			18.373 *
07-148-WR1-COMP	89.922	192.5			350.03	80.466				554.45	176.77 *	17.098 *	13.006 *

ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS) SCORESHEET

ONTARIO
PA NO. 07-148

AIMSS SCORESHEET

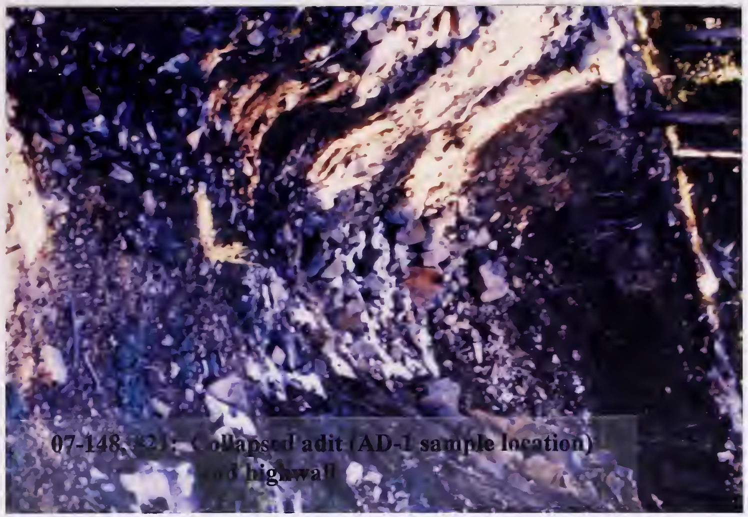
SITE NAME: ONTARIO
PA NUMBER: 07-148

LINE NO.				
		GROUNDWATER PATHWAY		
1	GW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A		CONTAINMENT		20
3B		GW DEPTH		20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	400
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	400
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.140
6	GW - TARGETS	WELLS - 1 MI. x 2.5		7.5
7		WELLS - 1 TO 4 MI		10
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	17.5
10		**GROUNDWATER SCORE**	LINES 4 x 5 x 9	980
		SURFACE WATER PATHWAY		
11	SW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
12		EXCEEDENCES		0
13A		CONTAINMENT		20
13B		DISTANCE TO SW		2
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	40
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	40
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.159
16	SW - TARGETS	DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		0
18		WETLANDS		10
19		FISHERY		5
20		RECREATION		5
21		IRRIGATION/STOCK		0
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 THRU 22	20
24		**SURFACE WATER SCORE**	LINES 14 x 15 x 23	127
		AIR PATHWAY		
25	AIR - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
26A		CONTAINMENT		10
26B		DISTANCE TO POPULATION		5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	50
27		LIKELIHOOD SCORE	LINES 25 + 26C	50
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.005
29	AIR - TARGETS	POPULATION - 4 MILES		30
30		NEAREST RESIDENCE		0
31		WETLANDS		0
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 THRU 33	30
35		**AIR PATHWAY SCORE**	LINES 27 x 28 x 34	8
		DIRECT CONTACT PATHWAY		
36	LIKELIHOOD OF EXPOSURE	OBSERVED EXPOSURE		0
37A		ACCESSIBILITY		10
37B		DISTANCE TO POPULATION		5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	50
38		LIKELIHOOD SCORE	LINES 36 + 37C	50
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.005
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE		1
41		NEAREST RESIDENCE		0
42		RECREATIONAL USE		0
43		TARGETS SCORE	SUM LINES 40 THRU 42	1
44		**DIRECT CONTACT SCORE**	LINES 38 x 39 x 43	0
45	**TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE** (LINES 10 + 24 + 35 + 44) / 100,000			**0.01**

SITE NAME: ONTARIO
PA NUMBER: 07-148

SITE SAFETY

LINE NO.				
1	THREAT	ACCESSIBILITY		1
2		OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	0
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	75
5		HAZ. STRUCTURES	40 EA.	40
6		EXPLOSIVE HAZARD		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 THRU 7	115
9		POPULATION - 1 MILE		1
10	TARGETS	NEAREST RESIDENCE		0
11		RECREATIONAL USE		0
12		TARGETS SCORE	SUM LINES 9 THRU 11	1
13		**SITE SAFETY SCORE**	(LINES 1 x 8 x 12) / 1,000	**1.15**



07-148, #21: Collapsed adit (AD-1 sample location) and highwall

07-148, #22: WR-1 from road (north)

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY
SITE INVESTIGATION LOG SHEET

Mine/Site Name: BENTON/BIG SNOWY **PA#:** 07-151

Date: September 25, 1995 **Time:** 0930-1210

Field Team Leader: Tuesday, Pioneer

Sampling Personnel: Flammang, Pioneer

Visitors: None

Weather/Seasonality Observations: Cold; sunny; clear.

Photographic Log (Photo No.'s/Video Tape Number)**:** #15: SE-1 downgradient sample location; #16: WR-1 from road below and north; #17: Two adits with highwall at WR-2; #18: WR-2 from southeast on top of dump; #19: WR-3 from above (south); #20: Adit highwall at WR-3. Video Tape No. 1

General Comments/Observations (not covered specifically in attached Inventory Forms)**:** Inventoried as Upper Big Snowy (07-151) and Lower Big Snowy (07-152), but literature refers to Benton Mine at this location.

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Move waste rock dumps from drainage, amend, and revegetate. Slope adit highwalls, cover, and revegetate.

I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): BENTON/BIG SNOWY **PA#:** 07-151

Legal Description: **T** 14N **;R** 8E **;Sec.** 27 **,** SW **1/4** NW **1/4** ____ **1/4**

County: CASCADE **Mining District:** NEIHART

Latitude: N 46° 56' 44" **Longitude:** W 110° 42' 04"

Primary Drainage Basin and Code: Belt Creek/10030105
Secondary Drainage Basin: Snow Creek/Carpenter Creek
USGS Quadrangle map name(s): Neihart

Mine Type/Commodities: Hardrock/Lead, Silver, Gold
Activity Status: Active ___**,Inactive/Exploration** X **,Abandoned** ___.

Ownership status: Known Y X **N** ___**; private/public?** Private
Owner, Agent, or Contact (Include address and phone when available)**:** Paul Hatfield, Lexington Silver Lead Mines, Inc., Benton Group Mining Co., P.O. Box 323, Veradale, WA 99037.

Relationship to other mines/sites in the area/district: 1/4 mile east of Big Seven; 1/4 mile west of Ripple & Rebellion Mines; connected underground to Tom Hendricks, Ripple & Flora claims.

Regulatory Status (Activity by other agencies)? Hardrock permits? Past Reclamation Activities? Investigated by MDHES (now MDEQ) in 1995 (Snow Creek)

General site features: Elevation 7500' **, Slope** 20°-30° **,**
Aspect North

Land use: Mining X **, Recreational** X **, Residential** ___**, Urban** ___**,**
Agricultural ___**, Other(Specify)** ___

Area of disturbed/unvegetated lands? 3 **acre(s).**
Site Dimensions: 675 feet x 200 feet
Predominant vegetation types: Lodgepole and Limber pines, spruce, alder

Access: roads - good (paved) ___**,poor (maintained dirt road)** ___**,**
4wd X **,trail** ___.
Other logistical considerations (proximity to other sites). Near Big Seven, Lexington, Ripple & Rebellion Mines; locked gate on Snow Creek Road, which is main access to site.

Well logs within 1 mile radius; (Attach MBMG Well Log Printout(s): There are 3 well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also note presence of radioactive minerals). Site lies in headwaters of unnamed tributary of Snow Creek. During the investigation, this tributary was dry throughout the site. Water leaving the site would flow north approximately 1 mile to confluence with Snow Creek. Snow Creek flows mostly west to confluence with Carpenter Creek about 1 mile away. Carpenter Creek flows southwest to confluence with Belt Creek 1.5 miles downstream. Site is underlain by quartzose gneiss and pinto diorite.

Mining/milling history, ore type/tenor, host rock, gangue: Production from 1905 to 1948 inclusive is reported to have been 54,713 tons of ore from which 1,033.47 oz. gold; 640,935 oz. silver; 9,407 lbs. copper; 1,128,733 lbs. lead; and 333,357 lbs. zinc were recovered. Mine was producing in 1891; by 1949 most adits were caved and inaccessible. The ore was highly siliceous; it contained abundant pyrite, with galena, sphalerite, silver sulfides, and some gold. Galena and sphalerite increased at depth.

Mine Operation?

Shafts - **Yes**___, **No** X, **#** ___, **Comment**
Adits - **Yes** X, **No**___, **#** 4, **Comment** All caved
Pits - **Yes**___, **No** X, **#** ___, **Comment**
Placers - **Yes**___, **No** X, **#** ___, **Comment**
Other - **Yes**___, **No** X, **#** ___, **Comment**

Mill Operation? **Yes**___, **No** X. **If yes answer the next three questions:**

Period(s) of Operation: N/A

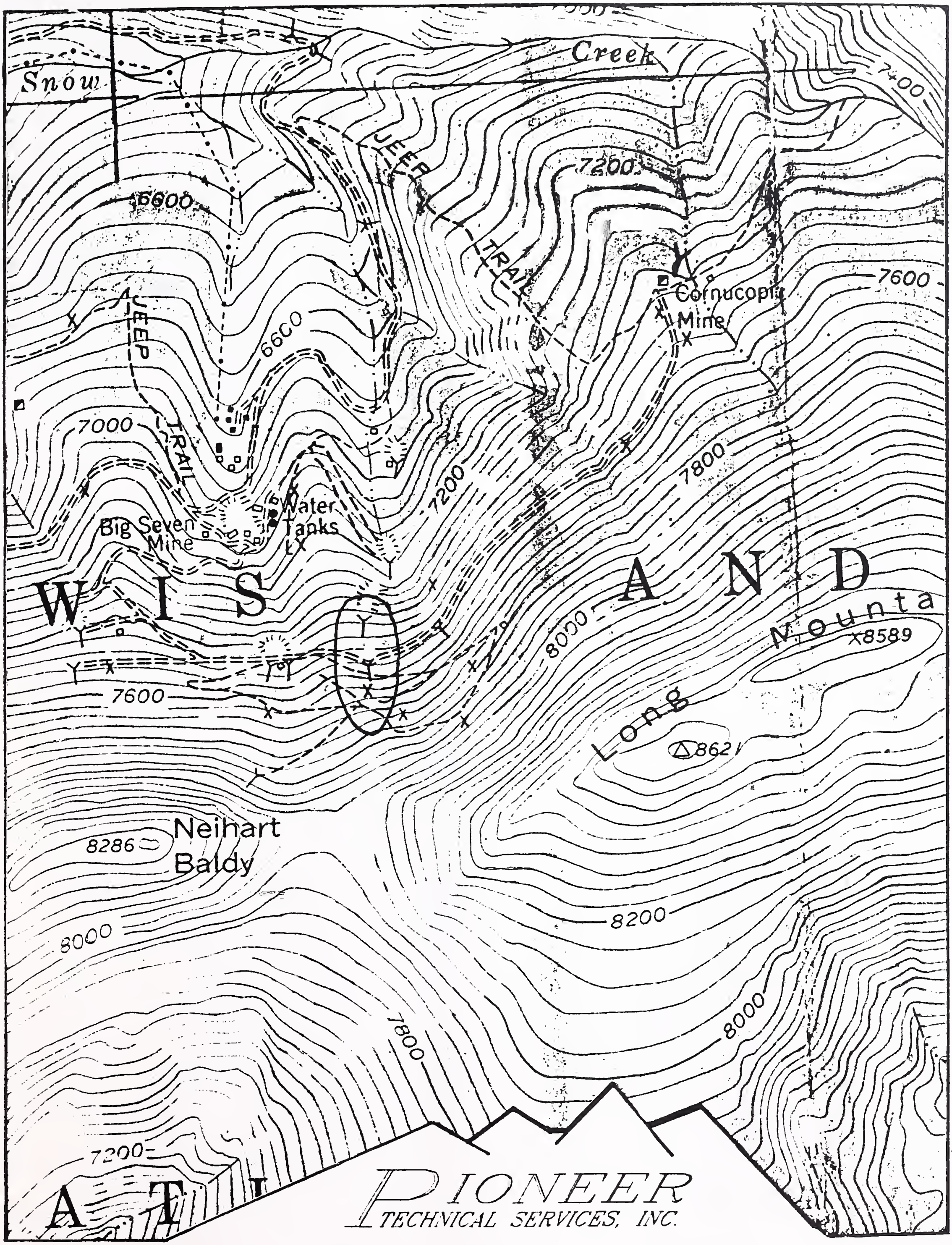
Origin of Ore Milled - Custom Mill___ **Dedicated Mill**___; **Number and names of mines that supplied mill feed:** For several years a gravity-type mill reportedly operated at the property. The mill was dismantled many years ago; no evidence of a mill (buildings or tailings) was found during this investigation.

Process? Hg-amalgam, CN^- leach (vat, heap), floatation, smelting?
N/A

Montana Bureau of Mines and Geology
Water Well Log Data

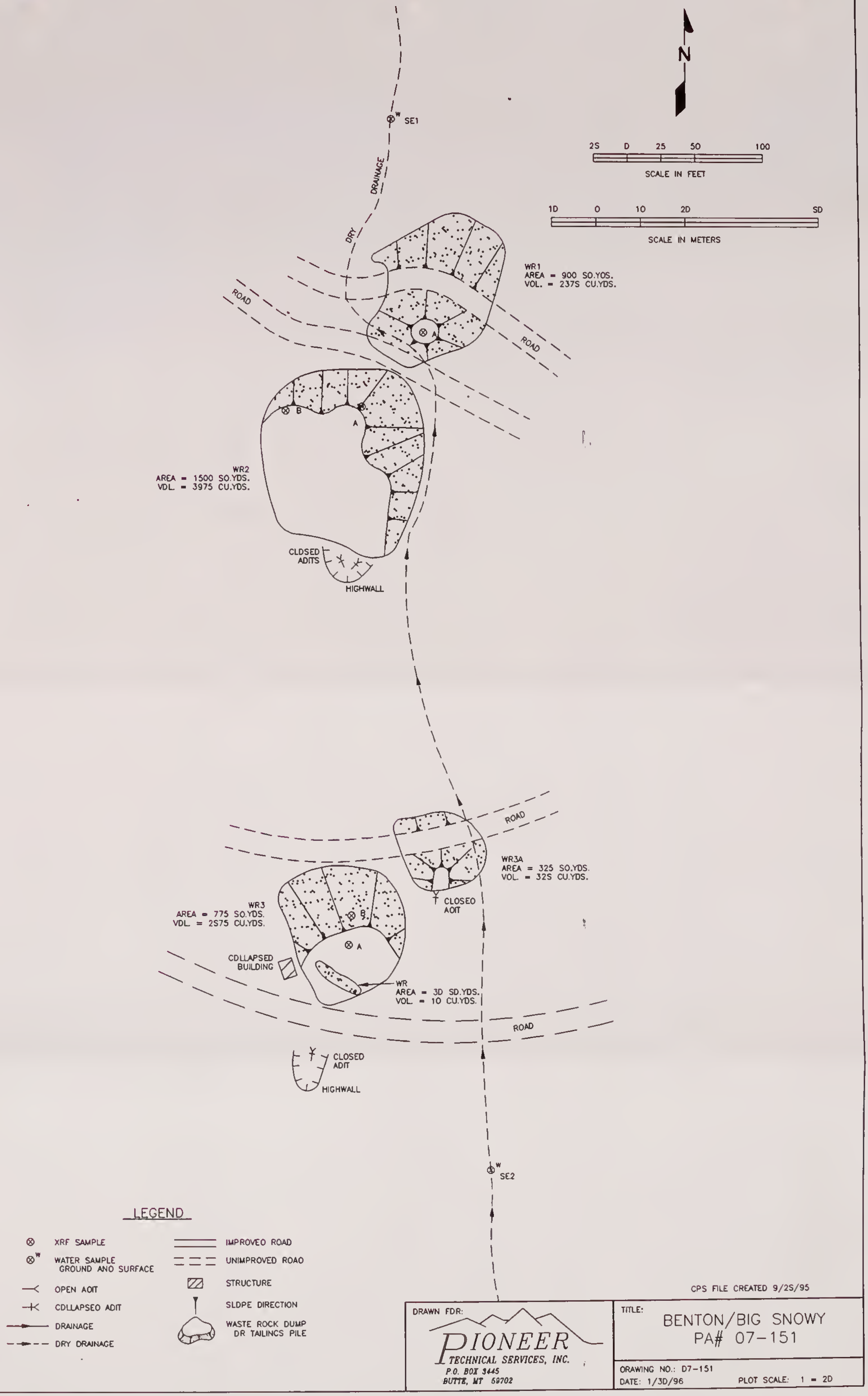
10/22/1993

Well No.	Location	Depth	Yield	Static Water Level
M:123062	14N 08E 20 DBA	41.0	4.0	24.00
M:123061	14N 08E 20 DBA	40.0	7.0	0.00
M:25649	14N 08E 32 BDC	120.0	8.0	7.00



PIONEER
TECHNICAL SERVICES, INC.

BENTON/BIG SNOWY, P.A. NO. 07-151
T14N, R08E, SECTION 27
SCALE 1" = 1000'



CPS FILE CREATED 9/25/95

DRAWN FOR:
PIONEER
TECHNICAL SERVICES, INC.
P.O. BOX 3445
BUTTE, MT 59702

TITLE:
BENTON/BIG SNOWY
PA# 07-151

DRAWING NO.: 07-151
DATE: 1/30/96
PLOT SCALE: 1 = 20

II. INFORMATION COLLECTED ON SITE

A. SOLID MATRIX WASTE CHARACTERIZATION

1. **Waste Characteristics** - *Use table on following page.*

Unique source identification: (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TP); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures/vessels sound, are runon/runoff controls in place, are wastes covered or vegetated, pond liners intact?

2. **TAILINGS IMPOUNDMENTS** - *If tailings impoundments are also present, complete the following questions.*

Describe the tailings grain size distribution (approximate % sand, silt, & clay): N/A

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): N/A

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): N/A

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): N/A

Comments on potential for mitigation: N/A

SOURCE INVENTORY FORM

SAMPLERS: Tuesday, Flammang

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd³)	LOCATION/DESCRIPTION	CONTAIN-MENT	pH SU (D/S)*	RADIO-ACTIVITY (mR/HR)	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
WR-1	WR	2,375	Lowest dump, cone shaped	None	6.4	0.04	07-151-WR-1	09/25/95 1850	T-Metals, ABA
WR-2A	WR	3,975	Large, middle dump; east side	None	4.6	0.06			
WR-2B	WR		Large, middle dump, west side	None	6.0	0.05			
WR-3A	WR	325	Upper east dump; top east side	None	6.6	0.05	07-151-WR-3	09/25/95 1900	T-Metals, ABA
WR-3B	WR	2,575	Upper west dump, center north	None	< 3.5	0.05			

* pH readings were taken directly on-site (Kelway Meter).

Comments or deviations from SOPs: 07-151-WR-1 is a composite of WR-1, -2A, and -2B. 07-151-WR-3 is a composite of WR-3A and -3B. Background sample was collected at the Ripple Mine (07-163-SS-1) during the 1994 investigation.

B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes____, No X , Number:____ Identification:________

Filled shafts: Yes____, No X , Number:____ Identification:________

Seeps/Springs: Yes____, No X , Number:____ Identification:________

Groundwater wells within 4 miles?: Yes X , No____;
Number of well logs: 13

Distance to nearest well used for drinking:
____<1,000 ft;____1,000 ft to 0.5 miles; X >0.5 miles.

Sample types: Flowing adits (AD); filled shafts (SH); Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?
Definite_____, **Probable**_____, **Possible** X , **Unlikely**_____.
Large dumps; moderate metals and pH

Approximate Depth to Groundwater:____<25 ft; X 25 - 100 ft;____ >100 ft.

Other observations/notes: N/A

GROUNDWATER INVENTORY FORM

SAMPLERS: ______________________________

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SOURCE	FLOW* cfs/gpm	pH SU	SC μS/cm @ 25°C	Eh mV	Temp °C	ALK. mg/L as $CaCO_3$	Depth ft	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
No samples were taken.												

FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): ______________________________

____

____

C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/run-off) and directions on sketch maps.

Flowing streams: Yes____, No X, Name(s):

Dry streambeds: Yes X, No____, Name(s): Unnamed tributary of Snow Creek

Other surface water: Yes____, No X, Name(s)/Description:

Waste materials within any floodplain: Yes X, No____ Source ID(s): WR-1, WR-2, WR-3A

Approximate Flood frequency? X 1 yr, ___10 yr, ___100 yr

Estimated seasonal flow of stream(s) (cfs/gpm)? 0
High Flow: 0.2 cfs, **Average Flow:** 0

Distance between waste source(s) and nearest surface water body (ft)? 0 feet between WR-1, WR-2, and WR-3A when water is flowing

Surface water draining onto or through waste sources: Yes____, No X,
Describe: Only when stream is flowing (storms, snowmelt)

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?) Wetlands, fishery (Belt Creek), possible irrigation

Observed erosional/sedimentation/stream turbidity problems? Yes X, No______. **Distance downstream (ft)?** 0-500 X; 500-1,000___; >1,000___.
Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present): Dry streambed has waste rock down approximately 400 feet where it meets another mine (Rebellion).

SURFACE WATER INVENTORY FORM

SAMPLERS: Tuesday

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SAMPLE LOCATION	pH SU	SC $\mu S/cm$ @ 25°C	Temp °C	ALK. mg/L as $CaCO_3$	Flow* cfs/gpm	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
SE-1	SE	Downstream of site in dry drainage; 50' below WR-1	N/A	N/A	N/A	N/A	N/A	07-151-SE-1	09/25/95 1100	T-Metals
SE-2	SE	Upstream of site in dry drainage; 30' above WR-3	N/A	N/A	N/A	N/A	N/A	07-151-SE-2	09/25/95 1200	T-Metals

FLOW: Estimated (E) or Measured (M)?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): ______

D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

AMD Characteristics:

Presence and abundance of sulfides?	*(SO_3)*
Presence of evaporative salt deposits?	*(ESD)*
Discolored or turbid seepage?	*(SPG)*
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	*(FEOX)*
Presence of burned or stressed vegetation?	*(VEG)*
pH ≤ 5.0	*(pH)*

General Potential for AMD Mitigation:

Area available for treatment (acres)? None; site wastes are in steep drainage.

Wetlands present: Yes___, No X **, Describe:**

Carbonate rocks/soils: Yes___, No X **, Describe:**

E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10___; 10-30___; 30-100 X **; 100-300___; 300-1,000___; 1,000-3,000___; 3,000-10,000___; 10,000 or greater___; Comments** Town of Neihart

Nearest residence:___<1,000 ft;___1,000 ft - 0.5 miles; X **>0.5 miles.**

For each source (table next page):

Available fine materials? Surface area?

Uncovered and unvegetated? Wet or dry?

Overall dust propagation potential:
observed high moderate low none

ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

SAMPLERS: Tuesday, Flammang

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LIST)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/HIGH/MODERATE/LOW/NONE)
WR-1	FEOX	Dry	8,100	7,695	Yes	Moderate
WR-2	SO3; FEOX; pH	Dry	13,500	12,825	Yes	Moderate
WR-3	FEOX; SO3; pH	Dry	9,900	9,900	Yes	Moderate

Notes and Clarifications:

F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes____, No_X_,
Describe:____________________

Population within 1 mile: 1-10_X_; 10-30___; 30-100___; 100-300___;
300-1,000___; 1,000-3,000___; 3,000-10,000___; 10,000 or greater___;
Comments____________________

Evidence of recreational use on site: Yes___, No_X_, Describe:________
____

Accessibility (check each that apply):___Easily accessible - no fences, gates, or warning signs;_X_Moderately Accessible - barbed wire fences, road gated, or signs posted;___Difficult Access - chain-link fence, road gated and locked, site guarded (does not include locked or manned access points located more than 0.5 miles from the actual site).

Sensitive environments on-site or adjacent to site:
State or National Parks - Yes___, No_X_, Comment__________
Wilderness Area - Yes___, No_X_, Comment__________
T&E Species Habitat - Yes___, No_X_, Comment__________
Bat Habitat - Yes___, No_X_, Comment__________

Primary Drainage___; Secondary Drainage_X_; No Information___:
Riparian Habitat Quality - High___, Medium_X_, Low___
Wetlands Frontage - High___, Medium___, Low_X_
Fisheries Habitat and Species Classification - _6_
Sport Fishery Classification - _6_

G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes___, No_X_, Number____, types and locations:___
____

Hazardous structures: Yes_X_, No___, Number_1_, types and locations:_
Small wood building at WR-3

Unstable highwalls, pits, trenches, slopes: Yes_X_, No___, Number_2_,
types and locations: Adits at WR-2 and WR-3

Unstable waste piles, impoundments, undercut banks: Yes____, No_X_,
Number____, types and locations:__________

Fire and/or Explosion hazards: Yes___, No_X_, Explain:__________
____

Bibliography

MBMG, Well Log Database, July 14, 1994.

MDFWP, Montana Rivers Information System Rivers Report, Prepared by Montana Natural Resource Information System, July 1995.

MDHES/SHWB, Superfund Basics, Overview and Accomplishments of Superfund in Montana 1983-1993, November 1993.

MDEQ/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for Upper Big Snowy, Prepared by Chen-Northern, October 19, 1989.

USGS, Topographic Map, Neihart, Montana, 7 1/2 minute Quadrangle, 1961.

LABORATORY ANALYTICAL DATA

BENTON/BIG SNOWY
PA NO. 07-151

Benton/ Big Snowy (2 sites) PA# 07-151
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/25/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
07-151-SE-1	9.8 J	99.6	68.9	12.4 J	2030	8.0	5.5	57.8	27600	1650	2680	833	0.14	5.9	28.3	2810 J	NR
07-151-SE-2	6.8 UJ	110	423	2.1 J	1450	14.7	4.9	136	26100	2090	3650	558	0.38	8.6	58.2	596 J	NR
07-151-WR-1	28.9 J	95.4	16.9	22.6 J	184	3.0	1.7 U	65.6	15300	3210	314	69	0.48	2.2 U	50.7	5000 J	NR
07-151-WR-3	22.1 J	160	69.1	1.7 J	2470	4.8	2.0 U	169	26700	3560	684	91.3	0.36	2.9	60.4	361 J	NR
BACKGROUND	4.7 UJ	9.6	87.6	1.32 JX	NR	27.2 J	9.05 J	10.8 J	21100	52.4 JX	NR	708 J	0.04	10.3	0.5 B	135	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Request

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
07-151-WR-1	0.58	18.1	-1.53	-19.6	0.35	0.08	0.15	2.50	-4.03	-4.03	-8.46	15.39	-21.15	-44.42
07-151-WR-3	0.90	28.1	-21.92	-31.0	0.86	<0.01	0.04	0.00	-2.92	-2.92	-6.13	21.41	-54.16	-113.74

Legend

SE-1- Downstream of site, 50' below WR1.
SE-2- Upstream of site, 30' above WR3.
WR-1- Composite of WR1, 2A, 2B.
WR-3- Composite of WR3A, WR3B.
BACKGROUND- From the Ripple (07-163-SS1) (1994 data).

XRF ANALYSIS RESULTS

BENTON/BIG SNOWY
PA NO. 07-151

Mine Name: Benton/Big Snowy PA No. 07-151
XRF Field Analyses
Results in PPM

XRF SAMPLE I.D.	CrHI	K	Ca	Tl	CrLO	Mn	Fe	Co	Ni	Cu	Zn	As	Se
07-151-WR1		40512	2032.9	2927.6			46990	475.38 *			700.68		
07-151-WR2A		39461	1275.2 *	3193.8			14763			86.078 *	1635.1		
07-151-WR2B		35259	2011.6	3257.6			41058	561.92 *		200.73 *	2045.2		
07-151-WR3A		36087	3051.5	3552.6			42946	843.61 *		351.44	506.85		
07-151-WR3B		43526	7830.8	4228.4	286.7 *		46508	508.2 *		96.209 *	413.77		
07-151-WR1-COMP		42141	1843.9	3226.5			34558				979.17		
07-151-WR3-COMP		36161	4493	3985	260.49 *		37236			184.54 *	387.62		

XRF SAMPLE I.D.	Sr	Zr	Mo	Hg	Pb	Rb	Cd	Sn	Sb	Ba	Ag	U	Th
07-151-WR1	73.188	152.79			1446.8	256.01				511.22			
07-151-WR2A	43.181	140.69			4142.3	199.04				213.71	168 *		
07-151-WR2B	79.052	199.66			3762.2	247.88			246.84	400.34	292.39 *		
07-151-WR3A	132.04	195.7			4157.1	242.13			97.645 *	467.43	370.3 *		
07-151-WR3B	113.14	134.71			2294.2	294.65				458.24	179.62 *		
07-151-WR1-COMP	75.456	101.25			2919.6	270.42				339.56	165.68 *		18.938 *
07-151-WR3-COMP	104.74	119.31			3176.7	257.6			83.669 *	459.27	209.27 *		

ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS) SCORESHEET

BENTON/BIG SNOWY
PA NO. 07-151

MDEQ AMRB/PIONEER 1/12/96

AIMSS SCORESHEET

SITE NAME: BENTON/BIG SNOWY
PA NUMBER: 07-151

LINE NO.				
		GROUNDWATER PATHWAY		
1		OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT		20
3B		GW DEPTH		10
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	200
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	200
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	13.559
6		WELLS - 1 MI. x 2.5		7.5
7	GW - TARGETS	WELLS - 1 TO 4 MI		10
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	17.5
10		**GROUNDWATER SCORE**	LINES 4 x 5 x 9	47457
		SURFACE WATER PATHWAY		
11		OBSERVED RELEASE		300
12	SW - LIKELIHOOD OF RELEASE	EXCEEDENCES		0
13A		CONTAINMENT		20
13B		DISTANCE TO SW		20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	400
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	700
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	14.889
16		DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		1
18		WETLANDS		10
19	SW - TARGETS	FISHERY		5
20		RECREATION		5
21		IRRIGATION/STOCK		0
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 THRU 22	21
24		**SURFACE WATER SCORE**	LINES 14 x 15 x 23	218868
		AIR PATHWAY		
25		OBSERVED RELEASE		0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT		15
26B		DISTANCE TO POPULATION		5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	75
27		LIKELIHOOD SCORE	LINES 25 + 26C	75
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.402
29		POPULATION - 4 MILES		30
30		NEAREST RESIDENCE		0
31	AIR - TARGETS	WETLANDS		0
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 THRU 33	30
35		**AIR PATHWAY SCORE**	LINES 27 x 28 x 34	905
		DIRECT CONTACT PATHWAY		
36		OBSERVED EXPOSURE		0
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY		10
37B		DISTANCE TO POPULATION		5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	50
38		LIKELIHOOD SCORE	LINES 36 + 37C	50
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.366
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE		1
41		NEAREST RESIDENCE		0
42		RECREATIONAL USE		0
43		TARGETS SCORE	SUM LINES 40 THRU 42	1
44		**DIRECT CONTACT SCORE**	LINES 38 x 39 x 43	18
45	**TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE**	(LINES 10 + 24 + 35 + 44) / 100,000		**2.67**

SITE NAME: BENTON/BIG SNOWY
PA NUMBER: 07-151

SITE SAFETY

LINE NO.				
1	THREAT	ACCESSIBILITY		10
2		OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	0
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	150
5		HAZ. STRUCTURES	40 EA.	40
6		EXPLOSIVE HAZARD		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 THRU 7	190
9		POPULATION - 1 MILE		1
10	TARGETS	NEAREST RESIDENCE		0
11		RECREATIONAL USE		0
12		TARGETS SCORE	SUM LINES 9 THRU 11	1
13		**SITE SAFETY SCORE**	(LINES 1 x 8 x 12) / 1,000	**1.90**

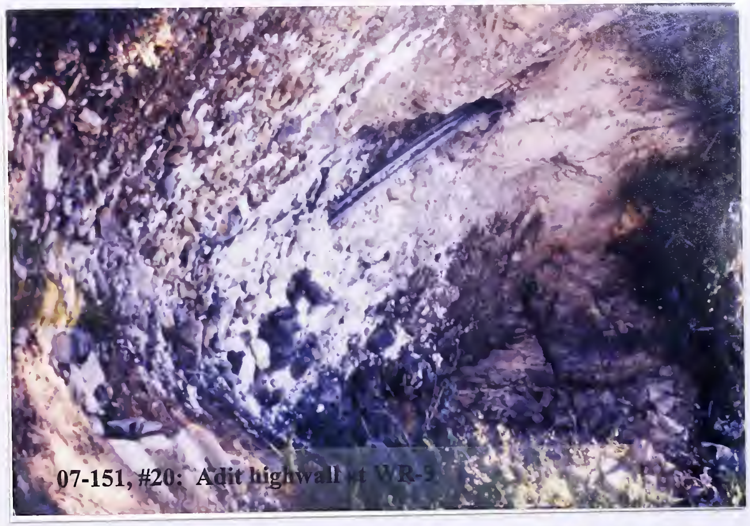
07-151, #15: [illegible]E-1 downgradient sediment location

07-[illegible] #[illegible]: WR-1 from road below and north

[illegible] #17: Two adits with highwall at W[illegible]

07-151, #18: WR-2 from southeast on top of dump

[illegible]



07-151, #20: Adit highwall at WR-3

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY
SITE INVESTIGATION LOG SHEET

Mine/Site Name: LUCKY STRIKE **PA#:** 07-169

Date: September 24, 1995 **Time:** 0900-1230

Field Team Leader: Tuesday, Pioneer

Sampling Personnel: Flammang, Pioneer
Sampson, Pioneer

Visitors: None

Weather/Seasonality Observations: Cold; frosty; clear; sunny.

Photographic Log (Photo No.'s/Video Tape Number)**:** #26: WR-1 from road below; #27: AD-1 sample location at WR-2 and discharge from road above; #28: WR-2 from east; #1: Open adit at WR-3; #2: WR-3 from west; #3: Adit discharge (AD-1 sample location) and highwall at WR-2. Video Tape No. 1

General Comments/Observations (not covered specifically in attached Inventory Forms)**:**
N/A

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Reroute adit around and away from waste rock dump. Grade out waste rock dumps and revegetate. Possibly treat water from adit discharge. Backfill adit depressions with waste rock and revegetate.

I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): LUCKY STRIKE **PA#:** 07-169

Legal Description: **T** 14N **;R** 8E **;Sec.** 28 **,** SE **1/4** NW **1/4**____**1/4**

County: CASCADE **Mining District:** NEIHART

Latitude: N 46° 56' 57" **Longitude:** W 110° 42' 55"

Primary Drainage Basin and Code: Belt Creek/10030105
Secondary Drainage Basin: Snow Creek/Carpenter Creek

USGS Quadrangle map name(s): Neihart

Mine Type/Commodities: Hardrock/Lead, Silver, Zinc
Activity Status: Active____**,Inactive/Exploration** X **,Abandoned**____**.**

Ownership status: Known Y X **N**____**; private/public?** Private
Owner, Agent, or Contact (Include address and phone when available)**:** Paul Hatfield, Lexington Silver Lead Mines, Inc., Benton Group Mining Co., P.O. Box 323, Veradale, WA 99037.

Relationship to other mines/sites in the area/district: 1/4 mile southwest of IXL/Eureka; 1/2 mile west of Big Seven; 1/4 mile northwest of Lexington Mines.

Regulatory Status (Activity by other agencies)? Hardrock permits? Past Reclamation Activities? Unknown

General site features: Elevation 7000'**, Slope** 15°-20°**,**
Aspect North

Land use: Mining X **, Recreational** X **, Residential**____**, Urban**____**,**
Agricultural____**, Other(Specify)**____

Area of disturbed/unvegetated lands? 8 **acre(s).**
Site Dimensions: 900 feet x 400 feet

Predominant vegetation types: Lodgepole pine, alder

Access: roads - good (paved)____**,poor (maintained dirt road)**____**,**
4wd X **,trail** X **.**
Other logistical considerations (proximity to other sites). West of Big Seven and Lexington Mines; locked gate on Snow Creek Road, main access to the area.

Well logs within 1 mile radius; (Attach MBMG Well Log Printout(s): There are 3 well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also note presence of radioactive minerals). Site lies on hillside well above drainage. Water leaving the site would flow north to unnamed tributary of Snow Creek approximately 1/4 mile downgradient. Snow Creek flows northwest 1/3 mile to confluence with Carpenter Creek. Carpenter Creek flows southwest to confluence with Belt Creek 2 miles downstream. Site is underlain by Snow Creek porphyry and pinto diorite.

Mining/milling history, ore type/tenor, host rock, gangue: Vein is in pinto diorite ranging from a few inches to 2 feet in width. Ore mineral is chiefly galena with small amounts of sphalerite and silver sulfides in a gangue of carbonates and quartz. Production from the Lucky Strike and Spotted claims 1921 to 1941 inclusive is reported to have been 132 tons of ore from which 119.1 oz. gold; 9,604 oz. silver; 494 lbs. copper; and 2,159 lbs. of lead were recovered.

Mine Operation?

Shafts - **Yes**___, **No** X, **#** ___, **Comment**___
Adits - **Yes** X, **No**___, **#** 4, **Comment** 1 partially open; 1 discharging
Pits - **Yes**___, **No** X, **#** ___, **Comment**___
Placers - **Yes**___, **No** X, **#** ___, **Comment**___
Other - **Yes**___, **No** X, **#** ___, **Comment**___

Mill Operation? Yes___, **No** X. **If yes answer the next three questions:**

Period(s) of Operation: N/A

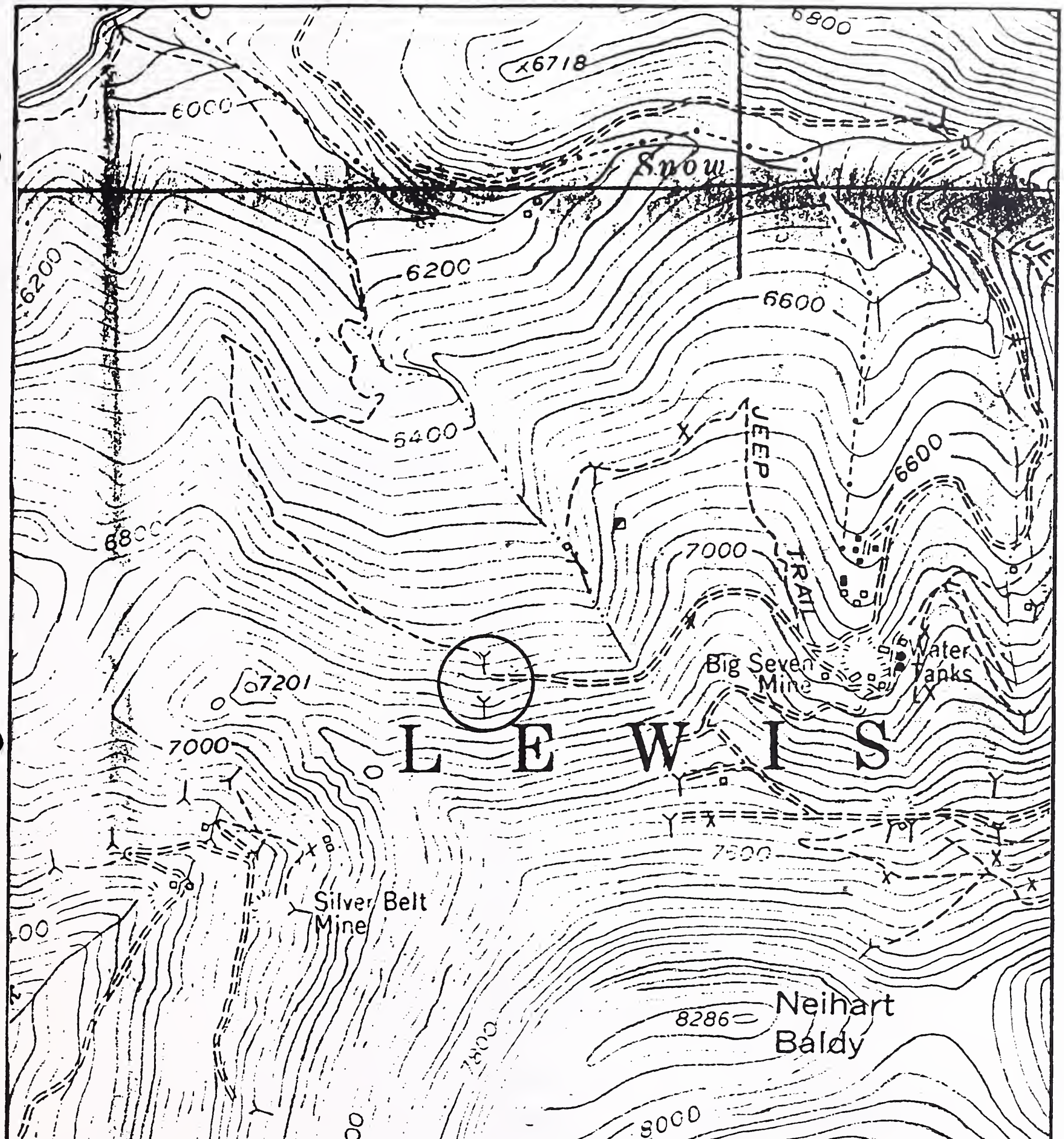
Origin of Ore Milled - Custom Mill___ **Dedicated Mill**___; **Number and names of mines that supplied mill feed:** N/A

Process? Hg-amalgam, CN$^-$ leach (vat, heap), floatation, smelting?
N/A

Montana Bureau of Mines and Geology
Water Well Log Data

08/10/1994

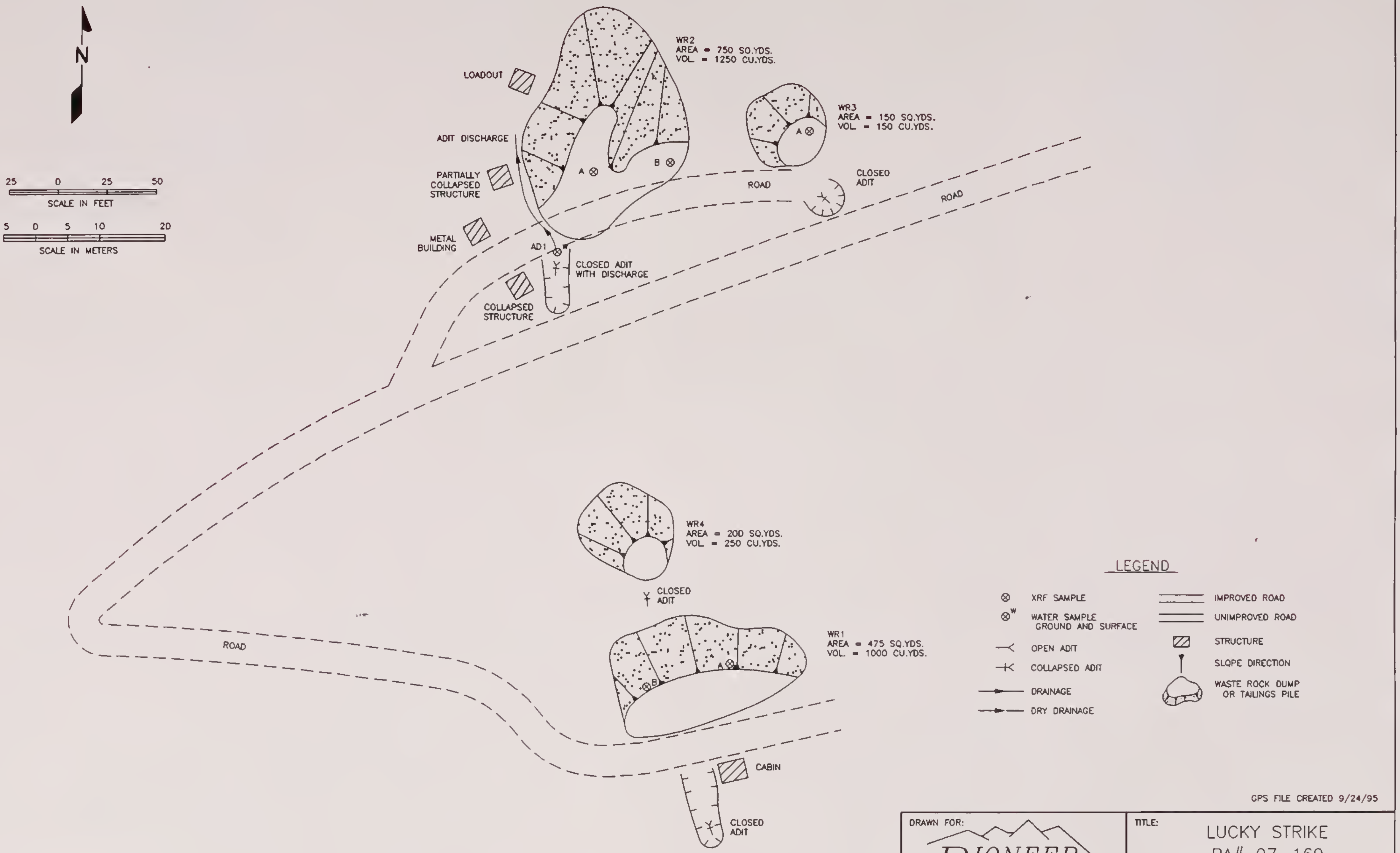
Well No.	Location	Depth	Yield	Static Water Level
[illegible]123062	14N 08E 20 DBA	41.0	4.0	24.00
M:123061	14N 08E 20 DBA	40.0	7.0	0.00
M:25649	14N 08E 32 BDC	120.0	8.0	7.00



LUCKY STRIKE, P.A. NO. 07-169

T14N, R08E, SECTION 28

SCALE: 1" = 1000'



GPS FILE CREATED 9/24/95

DRAWN FOR:

PIONEER
TECHNICAL SERVICES, INC.
P.O. BOX 3445
BUTTE, MT 59702

TITLE:

LUCKY STRIKE
PA# 07-169

DRAWING NO.: PT342105
DATE: 1/29/96
PLOT SCALE: 1 = 15

II. INFORMATION COLLECTED ON SITE

A. SOLID MATRIX WASTE CHARACTERIZATION

1. Waste Characteristics - *Use table on following page.*

Unique source identification: (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TP); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures/vessels sound, are runon/runoff controls in place, are wastes covered or vegetated, pond liners intact?

2. **TAILINGS IMPOUNDMENTS** - *If tailings impoundments are also present, complete the following questions.*

Describe the tailings grain size distribution (approximate % sand, silt, & clay): N/A

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): N/A

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): N/A

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): N/A

Comments on potential for mitigation: N/A

SOURCE INVENTORY FORM

SAMPLERS: Sampson

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd³)	LOCATION/DESCRIPTION	CONTAIN-MENT	pH SU (D/S)*	RADIO-ACTIVITY (mR/HR)	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
WR-1A	WR	1,000	Upper dump; east side	None	4.6	0.04	07-169-WR-1	09/24/95 1930	T-Metals, ABA
WR-1B	WR		Upper dump; west side	None	4.8	0.05			
WR-2A	WR	1,250	Larger lower dump; north end	None	6.8	0.03			
WR-2B	WR		Larger lower dump; east end	None	4.2	0.04			
WR-3	WR	150	Lower east dump; north end	None	5.5	0.04			

* pH readings were taken directly on-site (Kelwey Meter).

Comments or deviations from SOPs: 07-169-WR-1 is a composite of WR-1A, -1B, -2A, -2B, and -3. Background sample was collected at the Ripple Mine (07-163-SS-1) during the 1994 investigation.

B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes X , No_____, **Number:** 1 **Identification:** AD-1 associated with WR-2

Filled shafts: Yes____, No X , **Number:**_____ **Identification:**______________

Seeps/Springs: Yes____, No X , **Number:**_____ **Identification:**______________

Groundwater wells within 4 miles?: Yes X , No____;
Number of well logs: 8

Distance to nearest well used for drinking:
____<1,000 ft;____1,000 ft to 0.5 miles; X >0.5 miles.

Sample types: Flowing adits (AD); filled shafts (SH); Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?
Definite_____, **Probable**_____, **Possible** X , **Unlikely**_____.
Low metals; moderate pH; sources located on ridge

Approximate Depth to Groundwater: X <25 ft;____ 25 - 100 ft;____ >100 ft.

Other observations/notes: N/A

GROUNDWATER INVENTORY FORM

SAMPLERS: Tuesday

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SOURCE	FLOW* cfs/gpm	pH SU	SC $\mu S/cm$ @ 25°C	Eh mV	Temp °C	ALK. mg/L as $CaCO_3$	Depth ft	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
AD-1	AD	Adit associated with WR-2	1 gpm (E)	7.98	248	193	3.3	33	N/A	07-169-AD-1	09/24/95 1035	T-Metals, TDS, Hardness, Cl, SO4

FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/run-off) and directions on sketch maps.

Flowing streams: Yes____, No X , Name(s):

Dry streambeds: Yes____, No X , Name(s):

Other surface water: Yes X , No____, Name(s)/Description: Adit discharge flows on and around dump.

Waste materials within any floodplain: Yes____, No X Source ID(s):

Approximate Flood frequency?___1 yr,___10 yr,___100 yr

Estimated seasonal flow of stream(s) (cfs/gpm)? N/A
High Flow:____________, **Average Flow:**

Distance between waste source(s) and nearest surface water body (ft)? 1,000 feet

Surface water draining onto or through waste sources: Yes X , No____,
Describe: Adit discharge ponds on WR-2 and flows off.

Surface water use within 15 miles downstream? **(Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)**
Belt Creek has fishery, recreational, and agricultural uses.

Observed erosional/sedimentation/stream turbidity problems? Yes_____,
No X . **Distance downstream (ft)?** 0-500___; 500-1,000___; >1,000___.
Describe/explain **(Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present):**

SURFACE WATER INVENTORY FORM

SAMPLERS: ______________________________

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SAMPLE LOCATION	pH SU	SC $\mu S/cm$ @ 25°C	Temp °C	ALK. mg/L as $CaCO_3$	Flow* cfs/gpm	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
No samples were taken.										

FLOW: Estimated (E) or Measured (M)?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): ______________________________

____

____

D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

AMD Characteristics:

Presence and abundance of sulfides?	*(SO_3)*
Presence of evaporative salt deposits?	*(ESD)*
Discolored or turbid seepage?	*(SPG)*
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	*(FEOX)*
Presence of burned or stressed vegetation?	*(VEG)*
pH ≤ 5.0	*(pH)*

General Potential for AMD Mitigation:

Area available for treatment (acres)? 2 acres, steep hillside

Wetlands present: Yes___, No X , Describe:

Carbonate rocks/soils: Yes___, No X , Describe:

E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10___; 10-30___; 30-100 X ; 100-300___; 300-1,000___; 1,000-3,000___; 3,000-10,000___; 10,000 or greater___; Comments Town of Neihart

Nearest residence:___<1,000 ft;___1,000 ft - 0.5 miles; X >0.5 miles.

For each source (table next page):

Available fine materials? Surface area?

Uncovered and unvegetated? Wet or dry?

Overall dust propagation potential:
observed high moderate low none

ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

SAMPLERS: Sampson, Tuesday

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LIST)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/HIGH/MODERATE/LOW/NONE)
WR-1	SO3; FEOX; pH	Dry	4,275	4,275	Yes	Low
WR-2	SO3; FEOX; pH	Partial	6,750	6,410	Yes	Low
WR-3	FEOX	Dry	1,350	1,350	Yes	Low
AD-1	Manganese-oxide	N/A	N/A	N/A	N/A	N/A

Notes and Clarifications:

F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes____, No_X_
Describe:____________________

Population within 1 mile: 1-10_X_; 10-30___; 30-100___; 100-300___; 300-1,000___; 1,000-3,000___; 3,000-10,000___; 10,000 or greater___;
Comments____________________

Evidence of recreational use on site: Yes_X_, No___, Describe:____
4-wheeler tracks

Accessibility (check each that apply): ___Easily accessible - no fences, gates, or warning signs; _X_Moderately Accessible - barbed wire fences, road gated, or signs posted; ___Difficult Access - chain-link fence, road gated and locked, site guarded (does not include locked or manned access points located more than 0.5 miles from the actual site).

Sensitive environments on-site or adjacent to site:
State or National Parks - Yes___, No_X_, Comment__________
Wilderness Area - Yes___, No_X_, Comment__________
T&E Species Habitat - Yes___, No_X_, Comment__________
Bat Habitat - Yes_X_, No___, Comment Open adit

Primary Drainage_X_; Secondary Drainage___; No Information___:
Riparian Habitat Quality - High_X_, Medium___, Low___
Wetlands Frontage - High___, Medium_X_, Low___
Fisheries Habitat and Species Classification - _3_
Sport Fishery Classification - _3_

G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes_X_, No___, Number_1_, types and locations:___
Adit at WR-3 (1 foot x 3 feet opening)

Hazardous structures: Yes_X_, No___, Number_3_, types and locations:_
One metal shed and two loadouts at WR-2

Unstable highwalls, pits, trenches, slopes: Yes_X_, No___, Number_3_, types and locations: Highwalls associated with adits at WR-1, -2, and -3.

Unstable waste piles, impoundments, undercut banks: Yes____, No_X_, Number____, types and locations:____________________

Fire and/or Explosion hazards: Yes___, No_X_, Explain:__________

Bibliography

MBMG, Geology and Ore Deposits of the Neihart Mining District, Cascade County, Montana, Memoir 13, Written by Paul A. Schafer, July 1935.

MBMG, Well Log Database, July 14, 1994.

MDFWP, Montana Rivers Information System Rivers Report, Prepared by Montana Natural Resource Information System, July 1995.

MDHES/SHWB, Superfund Basics, Overview and Accomplishments of Superfund in Montana 1983-1993, November 1993.

MDEQ/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for Lucky Strike, Prepared by Chen-Northern, October 25, 1989.

MDEQ/AMRB Files, Hazardous Materials Inventory Site Investigation Log Sheet for Lexington No. 4, Prepared by Pioneer Technical Services, Inc., June 9, 1994.

USBM, Mines and Mineral Deposits (Except Fuels), Cascade County, Montana, Information Circular No. 7589, Written by Almon F. Robertson, April 1950.

USGS, Topographic Map, Neihart, Montana, 7 1/2 minute Quadrangle, 1961.

LABORATORY ANALYTICAL DATA

LUCKY STRIKE
PA NO. 07-169

Lucky Strike PA# 07-169
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/24/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
07-169-WR-1	32.1 J	61.6	46.9	6.2 J	2230	11.5	11.2	224	37100	954	3070	3000	0.94	10.3	59.1	1200 J	NR
BACKGROUND	4.7 UJ	9.6	87.6	1.32 JX	NR	27.2 J	9.05 J	10.8 J	21100	52.4 JX	NR	708 J	0.04	10.3	0.5 B	135	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
07-169-WR-1	0.55	17.2	2.83	-14.4	0.20	0.07	0.28	2.19	0.64	0.64	1.34	15.63	-15.99	-33.59
07-169-WR-1 DUP	0.55	17.2	3.23	-14.0	0.21	0.05	0.29	1.56	1.67	1.67	3.51	15.55	-15.40	-32.33

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Al (ug/L)	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
07-169-AD-1	172 JX	4.4 J	2.0	8.6	0.91	29900	10.7	10.9 U	21.3	665	6.8	10500	811	0.16 U	13.9 U	1.3	135	118

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
07-169-AD-1	159	< 5	51	NR	NR

Legend

WR-1- Composite of WR1A, 1B, 2A, 2B, 3
BACKGROUND- From the Ripple (07-163-SS1) (1994 data).
AD-1- Adit at WR-2.

XRF ANALYSIS RESULTS

LUCKY STRIKE
PA NO. 07-169

Mine Name: Lucky Strike PA No. 07-169
XRF Field Analyses
Results in PPM

XRF SAMPLE I.D.	CrHI	K	Ca	TI	CrLO	Mn	Fe	Co	Ni	Cu	Zn	As	Se
07-169-WR1A		24161	7567.2	4368.8		5552.4	50250	525.28 *		481.74	1545.9		
07-169-WR1B		23622	3635.4	4214.4		3236.9	55206			265.91 *	524.83		
07-169-WR2A		25853	2771.3	3516.4	239.01 *	2880.5	55402			80.147 *	441.38		
07-169-WR2B		27317	4804.1	4272.7	250.86 *	1187.5 *	37612			114.65 *	479.89		
07-169-WR3		28266	1708.2	3153.7			38260	495.84 *		217.15 *	333.62		27.941 *
07-169-WR1-COMP		28504	4819.5	3559.8		2030	44969	597.65 *		172.23 *	1127.2		

XRF SAMPLE I.D.	Sr	Zr	Mo	Hg	Pb	Rb	Cd	Sn	Sb	Ba	Ag	U	Th
07-169-WR1A	206.37	144.02	11.594 *		954.93	207.3			262.59	717.06	316.95 *		17.446 *
07-169-WR1B	167.86	112.92	17.073 *		658.97	204.44			116.83 *	988.33	238.17 *		23.59 *
07-169-WR2A	93.258	152.5	14.342 *		373.58	220.37				620.64	147.36 *		13.756 *
07-169-WR2B	153.34	100.84			759.24	212.93				687.06	198.26 *		14.819 *
07-169-WR3	81.259	114.28			2140.4	207.82			111.68 *	328.38	224.54 *		
07-169-WR1-COMP	122.33	72.753	7.1714 *		897.48	217.42			92.855 *	535.69	173.32 *		17.279 *

ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS) SCORESHEET

LUCKY STRIKE
PA NO. 07-169

AIMSS SCORESHEET

SITE NAME: LUCKY STRIKE
PA NUMBER: 07-169

LINE NO.				
		GROUNDWATER PATHWAY		
1	GW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A		CONTAINMENT		20
3B		GW DEPTH		20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	400
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	400
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	1.022
6	GW - TARGETS	WELLS - 1 MI. x 2.5		7.5
7		WELLS - 1 TO 4 MI		5
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	12.5
10		**GROUNDWATER SCORE**	LINES 4 x 5 x 9	5110
		SURFACE WATER PATHWAY		
11	SW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
12		EXCEEDENCES		0
13A		CONTAINMENT		20
13B		DISTANCE TO SW		2
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	40
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	40
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	1.145
16	SW - TARGETS	DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		0
18		WETLANDS		10
19		FISHERY		5
20		RECREATION		5
21		IRRIGATION/STOCK		0
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 THRU 22	20
24		**SURFACE WATER SCORE**	LINES 14 x 15 x 23	916
		AIR PATHWAY		
25	AIR - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
26A		CONTAINMENT		10
26B		DISTANCE TO POPULATION		5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	50
27		LIKELIHOOD SCORE	LINES 25 + 26C	50
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.110
29	AIR - TARGETS	POPULATION - 4 MILES		30
30		NEAREST RESIDENCE		0
31		WETLANDS		0
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 THRU 33	30
35		**AIR PATHWAY SCORE**	LINES 27 x 28 x 34	165
		DIRECT CONTACT PATHWAY		
36	LIKELIHOOD OF EXPOSURE	OBSERVED EXPOSURE		50
37A		ACCESSIBILITY		10
37B		DISTANCE TO POPULATION		5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	50
38		LIKELIHOOD SCORE	LINES 36 + 37C	100
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.099
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE		1
41		NEAREST RESIDENCE		0
42		RECREATIONAL USE		5
43		TARGETS SCORE	SUM LINES 40 THRU 42	6
44		**DIRECT CONTACT SCORE**	LINES 38 x 39 x 43	59
45	**TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE** (LINES 10 + 24 + 35 + 44) / 100,000			**0.06**

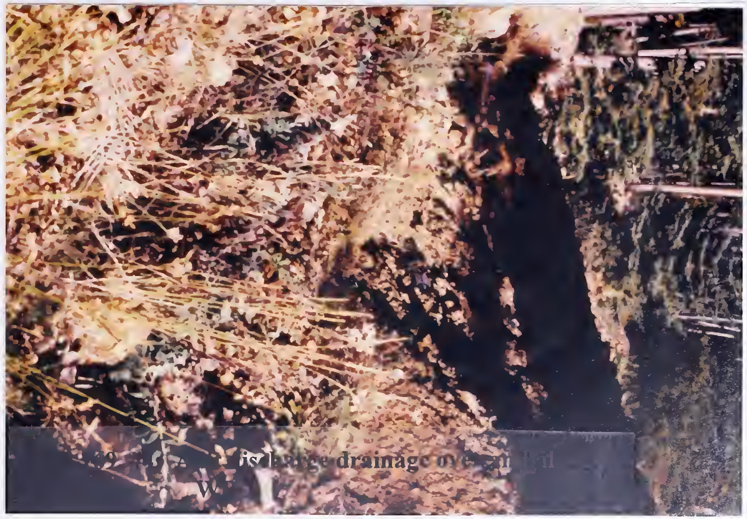
SITE NAME: LUCKY STRIKE
PA NUMBER: 07-169

LINE NO.		**SITE SAFETY**		
1	THREAT	ACCESSIBILITY		10
2	HAZARDS	OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	50
4		UNSTAB. HIWALLS / PITS	75 EA.	225
5		HAZ. STRUCTURES	40 EA.	120
6		EXPLOSIVE HAZARD		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 THRU 7	395
9	TARGETS	POPULATION - 1 MILE		1
10		NEAREST RESIDENCE		0
11		RECREATIONAL USE		5
12		TARGETS SCORE	SUM LINES 9 THRU 11	6
13		**SITE SAFETY SCORE**	(LINES 1 x 8 x 12) / 1,000	**23.70**

07-169, #1: Open adit at WR-3

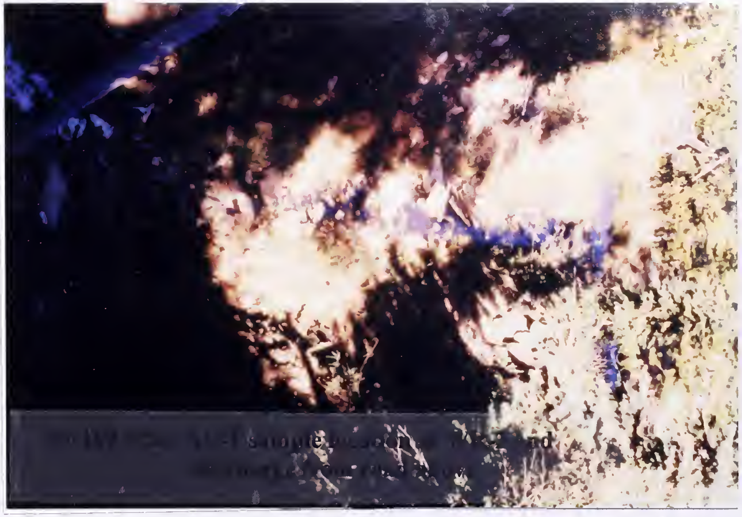
07-169, #2: WR-3 from west

07-16[illegible]



[illegible] Adit discharge drainage over [illegible] W[illegible]

07-169, #25: WR-1 from road below



[illegible] WR-1 sample [illegible] and [illegible]

07-169, #27: WR-2 from east

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY
SITE INVESTIGATION LOG SHEET

Mine/Site Name: LOWER BLACK DIAMOND JAY **PA#:** 07-174

Date: September 27, 1995 **Time:** 1330-1600

Field Team Leader: Tuesday, Pioneer

Sampling Personnel: Flammang, Liebelt, Pioneer

Visitors: None

Weather/Seasonality Observations: Cool; breezy; overcast; brief rain.

Photographic Log (Photo No.'s/Video Tape Number)**:** #4: North end of WR-1; #5: Adit with slight discharge; #6: South end of WR-1.
Video Tape No. 1

General Comments/Observations (not covered specifically in attached Inventory Forms)**:** Upper shaft was not investigated during this visit.

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Isolate toe of dump from stream, cover, and revegetate. Backfill upper shaft.

I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): LOWER BLACK DIAMOND JAY **PA#:** 07-174

Legal Description: T 14N ;R 8E ;Sec. 22 , SW 1/4 SW 1/4 ___ 1/4

County: CASCADE **Mining District:** NEIHART

Latitude: N 46° 57' 18" **Longitude:** W 110° 42' 00"

Primary Drainage Basin and Code: Belt Creek/10030105
Secondary Drainage Basin: Snow Creek/Carpenter Creek

USGS Quadrangle map name(s): Neihart

Mine Type/Commodities: Hardrock/Silver, Lead, Zinc
Activity Status: Active___, Inactive/Exploration___, Abandoned X .

Ownership status: Known Y X N___; private/public? Private
Owner, Agent, or Contact (Include address and phone when available): Paul Hatfield, Lexington Silver Lead Mines, Inc., Benton Group Mining Co., P.O. Box 323, Veradale, WA 99037.

Relationship to other mines/sites in the area/district: Near Rebellion and Big Seven Mines

Regulatory Status (Activity by other agencies)? Hardrock permits? Past Reclamation Activities? Unknown; upper shaft has been fenced.

General site features: **Elevation** 6800', **Slope** 20°, **Aspect** West

Land use: Mining X , Recreational X , Residential___, Urban___, Agricultural___, Other(Specify)___

Area of disturbed/unvegetated lands? 1.0 acre(s).
Site Dimensions: 300 feet x 150 feet

Predominant vegetation types: Lodgepole pine, willows, alder

Access: roads - good (paved)___, poor (maintained dirt road)___, 4wd X , trail___.
Other logistical considerations (proximity to other sites). Locked gate on Snow Creek Road

Well logs within 1 mile radius; (Attach MBMG Well Log Printout(s): There are 3 well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also note presence of radioactive minerals). Black Diamond is a group of five patented claims on the ridge between the upper forks of Snow Creek about two miles up Snow Creek from Carpenter Creek. Site lies on unnamed tributary to Snow Creek. The tributary flows north 1/4 mile to Snow Creek, which flows west 1 mile to confluence with Carpenter Creek. Carpenter Creek flows southwest 1.25 miles to confluence with Belt Creek.

Mining/milling history, ore type/tenor, host rock, gangue: Sulfide ore; no other information was found.

Mine Operation?

Shafts -	**Yes** X,	**No** ___,	**#** 1,	**Comment** Open, fenced
Adits -	**Yes** X,	**No** ___,	**#** 1,	**Comment** Caved, seepage
Pits -	**Yes** ___,	**No** X,	**#** ___,	**Comment**
Placers -	**Yes** ___,	**No** X,	**#** ___,	**Comment**
Other -	**Yes** ___,	**No** X,	**#** ___,	**Comment**

Mill Operation? Yes X, **No** ___. **If yes answer the next three questions:**

Period(s) of Operation: Built in 1909-10 and operated for 2 or 3 years

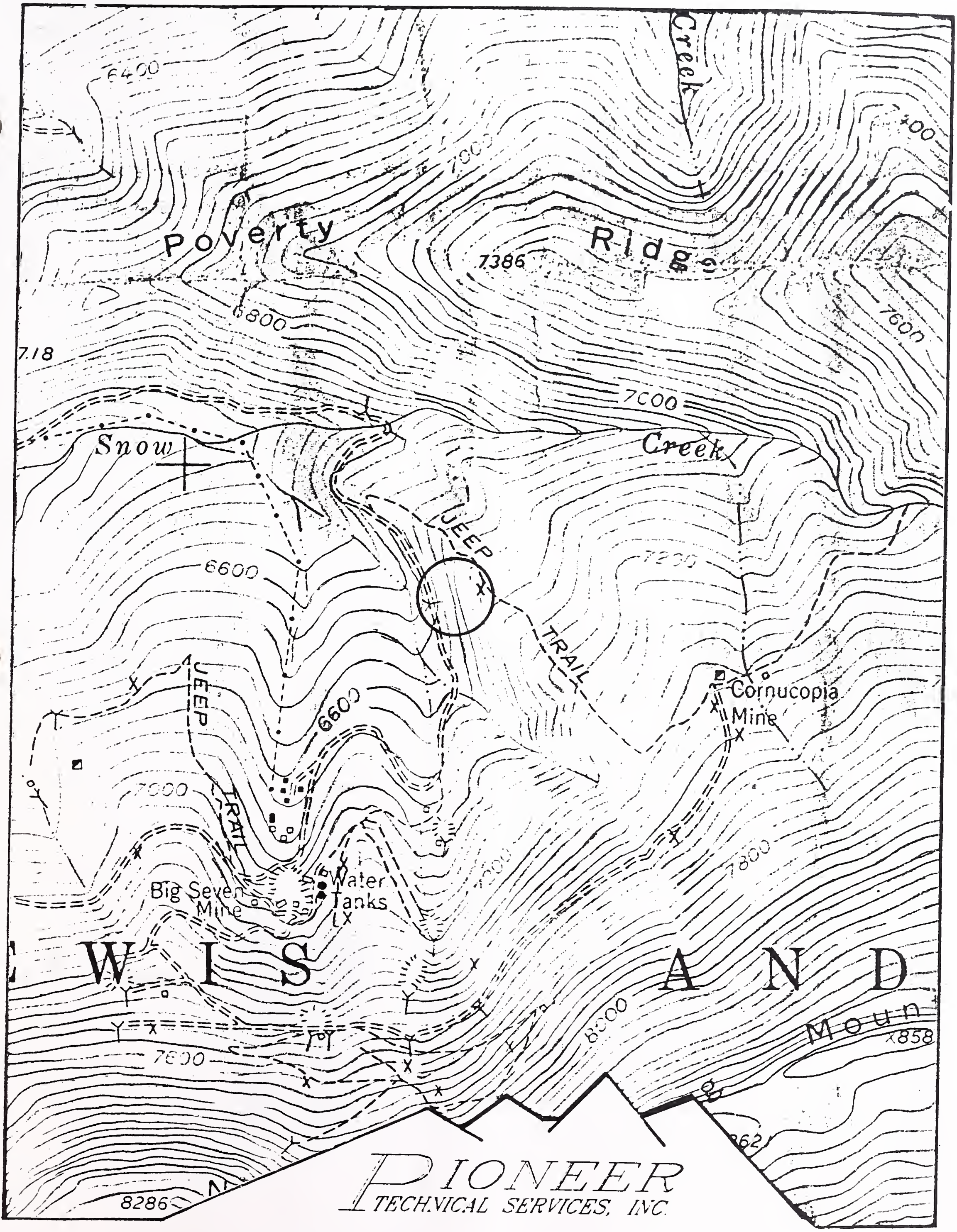
Origin of Ore Milled - Custom Mill ___ **Dedicated Mill** X; **Number and names of mines that supplied mill feed:**

Process? Hg-amalgam, CN$^-$ leach (vat, heap), floatation, smelting? 50 ton, gravity type mill; no tailings were found.

Montana Bureau of Mines and Geology
Water Well Log Data

10/22/1993

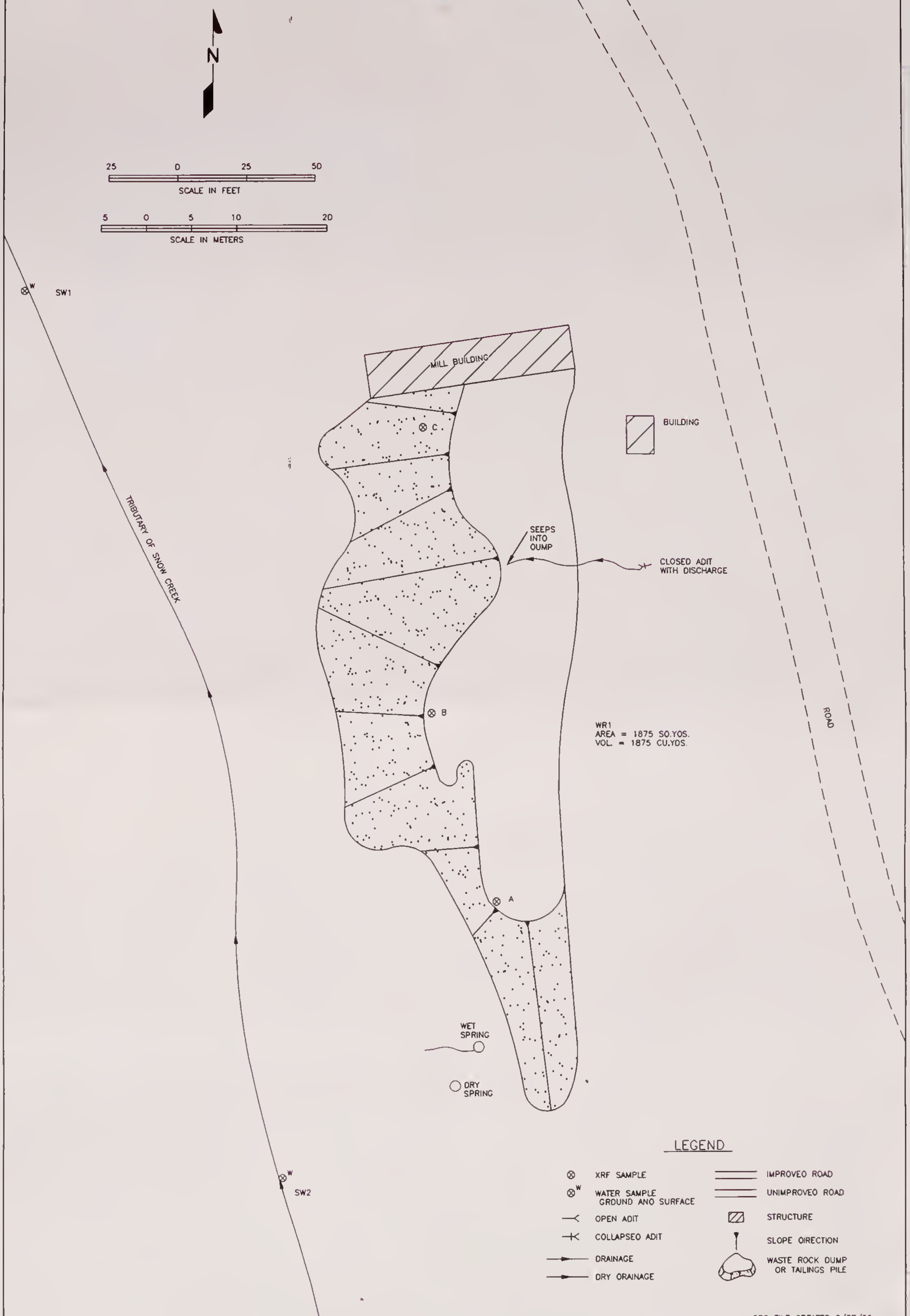
Well No.	Location	Depth	Yield	Static Water Level
M:123062	14N 08E 20 DBA	41.0	4.0	24.00
M:123061	14N 08E 20 DBA	40.0	7.0	0.00
M:25649	14N 08E 32 BDC	120.0	8.0	7.00



LOWER BLACK DIAMOND WAY, P.A. NO. 07-174

T14N R09E SECTION 22

SCALE 1" = 1000'



GPS FILE CREATED 9/27/95

DRAWN FOR:

PIONEER
TECHNICAL SERVICES, INC.
P.O. BOX 3445
BUTTE, MT 59702

TITLE:
LOWER BLACK DIAMOND JAY
PA# 07-174

DRAWING NO.: PT342106
DATE: 1/30/96
PLOT SCALE: 1 = 10

II. INFORMATION COLLECTED ON SITE

A. SOLID MATRIX WASTE CHARACTERIZATION

1. **Waste Characteristics** - *Use table on following page.*

Unique source identification: (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TP); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures/vessels sound, are runon/runoff controls in place, are wastes covered or vegetated, pond liners intact?

2. **TAILINGS IMPOUNDMENTS** - *If tailings impoundments are also present, complete the following questions.*

Describe the tailings grain size distribution (approximate % sand, silt, & clay): N/A

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): N/A

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): N/A

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): N/A

Comments on potential for mitigation: N/A

SOURCE INVENTORY FORM

SAMPLERS: Liebelt

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd³)	LOCATION/DESCRIPTION	CONTAIN-MENT	pH SU (D/S)*	RADIO-ACTIVITY (mR/HR)	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
WR-1A	WR	1,875	South portion of dump	None	6.2	0.07	07-174-WR-1	09/27/95 1540	T-Metals, ABA
WR-1B	WR		Middle portion of dump	None	5.3	0.05			
WR-1C	WR		North portion of dump	None	5.4	0.07			

* pH readings were taken directly on-site (Kelway Meter).

Comments or deviations from SOPs: 07-174-WR-1 is a composite of WR-1A through -1C. Background sample was collected from the Ripple Mine (07-163-SS-1) during the 1994 investigation.

B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes X **, No** ___ **, Number:** 1 **Identification:** AD-1

Filled shafts: Yes ___ **, No** X **, Number:** ___ **Identification:** ___

Seeps/Springs: Yes X **, No** ___ **, Number:** ___ **Identification:** North of WR-1

Groundwater wells within 4 miles?: Yes X **, No** ___ **;**
Number of well logs: 13

Distance to nearest well used for drinking:
___ **<1,000 ft;** ___ **1,000 ft to 0.5 miles;** X **>0.5 miles.**

Sample types: Flowing adits (AD); filled shafts (SH); Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?
Definite ___ **, Probable** X **, Possible** ___ **, Unlikely** ___ **.**
High metals; shallow groundwater with uncontained source.

Approximate Depth to Groundwater: X **<25 ft;** ___ **25 - 100 ft;** ___ **>100 ft.**

Other observations/notes: Evidence of many seeps in the area; dry during this investigation.

GROUNDWATER INVENTORY FORM

SAMPLERS: Tuesday, Flammang, Babits

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SOURCE	FLOW* cfs/gpm	pH SU	SC μS/cm @ 25°C	Eh mV	Temp °C	ALK. mg/L as $CaCO_3$	Depth ft	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
AD-1	AD	Adit discharge	1-2 gpm (E)	8.01	207	NM	6.1	NM	N/A	N/A*	08/0/95 0900	Field Parameters

*FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): Parameters taken during a site investigation for MDEQ/Environmental Remediation Division in August of 1995; no sample collected due to insufficient flow.

C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/run-off) and directions on sketch maps.

Flowing streams: Yes_X__, No____, Name(s):_ Unnamed tributary of Snow Creek

Dry streambeds: Yes_____, No_X_, Name(s):____

Other surface water: Yes______, No_X_, Name(s)/Description:_ Adit discharge just wet areas at this time, but usually flows; seeps at base of west end of WR-1.

Waste materials within any floodplain: Yes_X__, No___ **Source ID(s):** WR-1

Approximate Flood frequency? _X_1 yr, ___10 yr, ___100 yr

Estimated seasonal flow of stream(s) (cfs/gpm)? 20 gpm

High Flow: 60 gpm, **Average Flow:** 25 gpm

Distance between waste source(s) and nearest surface water body (ft)? 0 feet between WR-1 and unnamed tributary

Surface water draining onto or through waste sources: Yes_X__, No_____,

Describe: At wetter times of the year, adit discharges over dump.

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)

Wetlands, fishery (Belt Creek)

Observed erosional/sedimentation/stream turbidity problems? Yes______, No__X___. **Distance downstream (ft)?** 0-500____; 500-1,000____; >1,000____.

Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present):

SURFACE WATER INVENTORY FORM

SAMPLERS: Tuesday, Flammang

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SAMPLE LOCATION	pH SU	SC µS/cm @ 25°C	Temp °C	ALK. mg/L as $CaCO_3$	Flow* cfs/gpm	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
SW-1	SW	Downstream from site; 40' below collapsed mill structure	7.83	212	8.2	5	20 gpm (E)	07-174-SW-1	09/27/95 1440	T-Metals, TDS, Hardness, Cl, SO4
SE-1	SE	Downstream from site; 40' below collapsed mill structure	N/A	N/A	N/A	N/A	N/A	07-174-SE-1	09/27/95 1440	T-Metals
SW-2	SW	Upstream from site; 50' above WR-1	7.64	119	7.8	1	20 gpm (E)	07-174-SW-2	09/27/95 1450	T-Metals, TDS, Hardness, Cl, SO4
SE-2	SE	Upstream from site; 50' above WR-1	N/A	N/A	N/A	N/A	N/A	07-174-SE-2	09/27/95 1450	T-Metals

FLOW: Estimated (E) or Measured (M)?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): ____________________

D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

AMD Characteristics:

Presence and abundance of sulfides?	(SO_3)
Presence of evaporative salt deposits?	*(ESD)*
Discolored or turbid seepage?	*(SPG)*
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	*(FEOX)*
Presence of burned or stressed vegetation?	*(VEG)*
pH ≤ 5.0	*(pH)*

General Potential for AMD Mitigation:

Area available for treatment (acres)? 5 acres in floodplain

Wetlands present: Yes __X__, **No** ____, **Describe:** Below site in drainage and in Snow Creek floodplain

Carbonate rocks/soils: Yes ____, **No** __X__, **Describe:** ____

E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10____; **10-30**____; **30-100** __X__; **100-300**____; **300-1,000**____; **1,000-3,000**____; **3,000-10,000**____; **10,000 or greater**____; **Comments**____

Nearest residence:____**<1,000 ft;**____**1,000 ft - 0.5 miles;** __X__ **>0.5 miles.**

For each source (table next page):

Available fine materials? *Surface area?*

Uncovered and unvegetated? *Wet or dry?*

Overall dust propagation potential:
observed high moderate low none

ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

SAMPLERS: Liebelt

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LIST)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/HIGH/MODERATE/LOW/NONE)
WR-1	SO3; FEOX	Dry	5,625	4,500	Yes	Low

Notes and Clarifications:

F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes_____, No_X__
Describe:____

Population within 1 mile: 1-10_X_; 10-30___; 30-100___; 100-300___; 300-1,000___; 1,000-3,000___; 3,000-10,000___; 10,000 or greater___;
Comments____

Evidence of recreational use on site: Yes___, No_X_, Describe:________
____

Accessibility (check each that apply):___Easily accessible - no fences, gates, or warning signs;_X_Moderately Accessible - barbed wire fences, road gated, or signs posted;___Difficult Access - chain-link fence, road gated and locked, site guarded (does not include locked or manned access points located more than 0.5 miles from the actual site).

Sensitive environments on-site or adjacent to site:
State or National Parks - Yes___, No_X_, Comment____________________
Wilderness Area - Yes___, No_X_, Comment____________________
T&E Species Habitat - Yes___, No_X_, Comment____________________
Bat Habitat - Yes_X_, No___, Comment_Open shaft__________

Primary Drainage___; Secondary Drainage_X_; No Information___:
Riparian Habitat Quality - High___, Medium_X_, Low___
Wetlands Frontage - High___, Medium___, Low_X_
Fisheries Habitat and Species Classification - _4_
Sport Fishery Classification - _3_

G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes_X_, No___, Number_1__, types and locations:___
Shaft open above site on ridge____

Hazardous structures: Yes_X_, No___, Number_2__, types and locations:_
Buildings at WR-1____

Unstable highwalls, pits, trenches, slopes: Yes___, No_X_, Number____, types and locations:____

Unstable waste piles, impoundments, undercut banks: Yes____, No_X_, Number____, types and locations:___________________________________

Fire and/or Explosion hazards: Yes___, No_X_, Explain:________________
____

Bibliography

MBMG, Geology and Ore Deposits of the Neihart Mining District, Cascade County, Montana, Memoir 13, Written by Paul A. Schafer, July 1935.

MBMG, Well Log Database, July 14, 1994.

MDFWP, Montana Rivers Information System Rivers Report, Prepared by Montana Natural Resource Information System, July 1995.

MDHES/SHWB, Superfund Basics, Overview and Accomplishments of Superfund in Montana 1983-1993, November 1993.

MDEQ/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for Black Diamond Jay, Prepared by Chen-Northern, October 18, 1989.

MDEQ/AMRB Files, Hazardous Materials Inventory Site Investigation Log Sheet for Big Seven, Prepared by Pioneer Technical Services, Inc., May 27, 1993.

USBM, Mines and Mineral Deposits (Except Fuels), Cascade County, Montana, Information Circular No. 7589, Written by Almon F. Robertson, April 1950.

USGS, Topographic Map, Neihart, Montana, 7 1/2 minute Quadrangle, 1961.

LABORATORY ANALYTICAL DATA

LOWER BLACK DIAMOND JAY
PA NO. 07-174

Lower Black Diamond Jay PA# 07-174
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/27/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
07-174-SE-1	8.9 J	59.5	119	17.3 J	1520	23.2	16.0	142	21900	1180	4400	3330	0.051	18.9	44.2	3510 J	NR
07-174-SE-2	10.9 J	120	65.1	10.1 J	2090	41.1	18.9	167	39600	970	9680	3290	0.052	23.1	8.8	1750 J	NR
07-174-WR-1	6.0 UJ	223	33.0	2.7 J	4630	11.9	2.8	66.2	51400	8590	7030	609	0.47	7.1	12.9	644 J	NR
BACKGROUND	4.7 UJ	9.6	87.6	1.32 JX	NR	27.2 J	9.05 J	10.8 J	21100	52.4 JX	NR	708 J	0.04	10.3	0.5 B	135	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
07-174-WR-1	1.63	50.9	-0.66	-51.6	1.39	0.06	0.18	1.87	-2.54	-2.54	-5.33	40.08	-50.93	-106.95

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
07-174-SW-1	2.7 U	1.8 U	4.8 U	0.35	7230	9.6 U	10.9 U	4.4 U	43.8	1.3 UX	1830	5.2 UJ	0.16 U	13.9 U	0.21 UJX	7.6 U	25.6
07-174-SW-2	2.7 U	1.8 U	12.8	0.23	6720	9.6 U	10.9 U	4.4 U	117	2.4 JX	2030	8.4 J	0.16 U	13.9 U	3.0 JX	32.8	25.1

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
07-174-SW-1	<5.00	< 5	7	NR	NR
07-174-SW-2	10	< 5	14	NR	NR

Legend

SE-1- Downstream of site, 40' below collapsed mill structure.
SE-2- Upstream from site, 50' above WR1.
WR-1- Composite WR1A, WR1B, WR1C.
BACKGROUND- From the Ripple (07-163-SS1) (1994 data).
SW-1- Same as SE-1.
SW-2- Same as SE-2.

XRF ANALYSIS RESULTS

LOWER BLACK DIAMOND JAY
PA NO. 07-174

Mine Name: Lower Black Diamond Jay PA No. 07-174
XRF Field Analyses
Results in PPM

XRF SAMPLE I.D.	CrHI	K	Ca	TI	CrLO	Mn	Fe	Co	Ni	Cu	Zn	As	Se
07-174-WR1A		27661	1124.5 *	1719.9		1458.2 *	111038	1593.1 *		225.26 *	2832		
07-174-WR1A-DUP		26812	1347.5	1560.7		1048.2 *	109881	1387.7 *		169.2 *	3089.2		
07-174-WR1B	523.32 *	29424	28032	1648.1		679.46 *	69493	854.38 *			114.2 *		
07-174-WR1C		16316	8173.2	5260.8		2068.6	78659	869.81 *		91.926 *	246.01 *		
07-174-WR1-COMP		22972	12095	1942.6		1116.4 *	81148	889.46 *		90.547 *	711.06		

XRF SAMPLE I.D.	Sr	Zr	Mo	Hg	Pb	Rb	Cd	Sn	Sb	Ba	Ag	U	Th
07-174-WR1A	62.323 *	251.5			23977	157.52				534.08	196.01 *	27.662 *	
07-174-WR1A-DUP	65.191 *	262.73			23686	159.13				546.09	184.1 *	30.178 *	
07-174-WR1B	90.818	222.84			3095.2	181.17				367.56	176.56 *		
07-174-WR1C	233.21	166.84			189.91	132.28				848.78		15.743 *	19.264 *
07-174-WR1-COMP	128.54	190.41			9133.8	142.82				524.42			

ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS) SCORESHEET

LOWER BLACK DIAMOND JAY
PA NO. 07-174

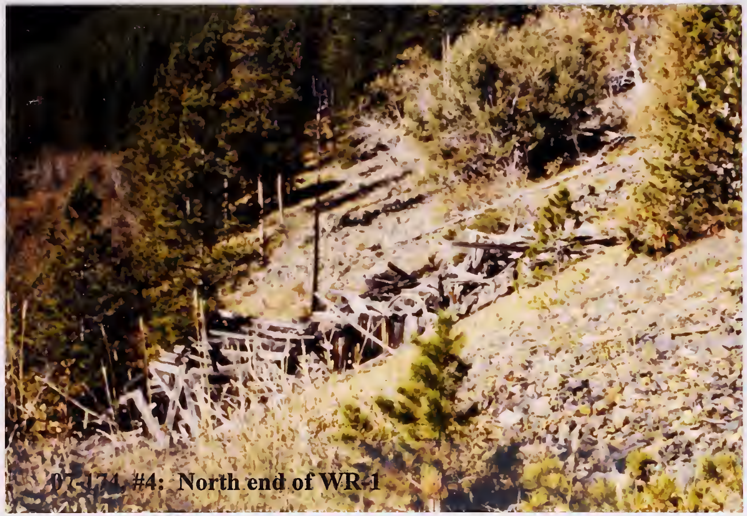
AIMSS SCORESHEET

SITE NAME: LWR BLACK DIAMOND JAY
PA NUMBER: 07-174

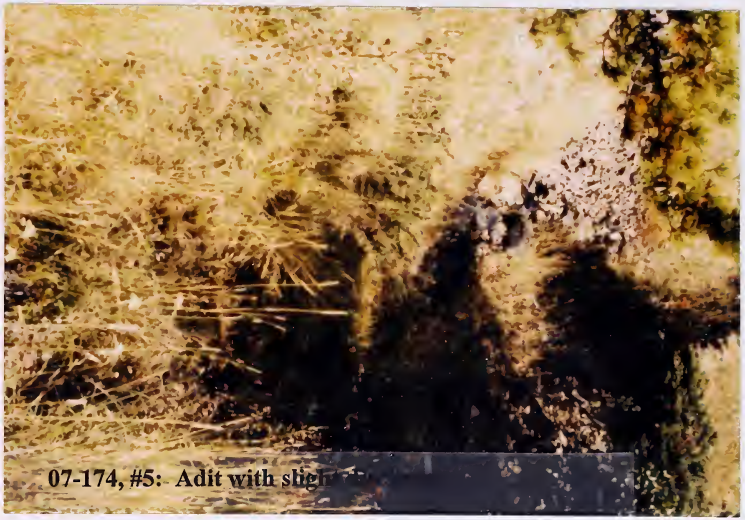
LINE NO.				
		GROUNDWATER PATHWAY		
1	GW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A		CONTAINMENT		20
3B		GW DEPTH		20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	400
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	400
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	8.755
6	GW - TARGETS	WELLS - 1 MI. x 2.5		7.5
7		WELLS - 1 TO 4 MI		10
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	17.5
10		**GROUNDWATER SCORE**	LINES 4 x 5 x 9	61285
		SURFACE WATER PATHWAY		
11	SW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		300
12		EXCEEDENCES		50
13A		CONTAINMENT		20
13B		DISTANCE TO SW		20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	400
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	750
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	9.641
16	SW - TARGETS	DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		0
18		WETLANDS		10
19		FISHERY		5
20		RECREATION		5
21		IRRIGATION/STOCK		0
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 THRU 22	20
24		**SURFACE WATER SCORE**	LINES 14 x 15 x 23	144615
		AIR PATHWAY		
25	AIR - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
26A		CONTAINMENT		10
26B		DISTANCE TO POPULATION		5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	50
27		LIKELIHOOD SCORE	LINES 25 + 26C	50
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.096
29	AIR - TARGETS	POPULATION - 4 MILES		30
30		NEAREST RESIDENCE		0
31		WETLANDS		0
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 THRU 33	30
35		**AIR PATHWAY SCORE**	LINES 27 x 28 x 34	144
		DIRECT CONTACT PATHWAY		
36	LIKELIHOOD OF EXPOSURE	OBSERVED EXPOSURE		0
37A		ACCESSIBILITY		10
37B		DISTANCE TO POPULATION		5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	50
38		LIKELIHOOD SCORE	LINES 36 + 37C	50
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.088
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE		1
41		NEAREST RESIDENCE		0
42		RECREATIONAL USE		0
43		TARGETS SCORE	SUM LINES 40 THRU 42	1
44		**DIRECT CONTACT SCORE**	LINES 38 x 39 x 43	4
45	**TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE** (LINES 10 + 24 + 35 + 44) / 100,000			**2.06**

SITE NAME: LWR BLACK DIAMOND JAY
PA NUMBER: 07-174

LINE NO.		SITE SAFETY		
1	THREAT	ACCESSIBILITY		10
2		OPEN SHAFTS	100 EA.	100
3		OPEN ADITS	50 EA.	0
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	75
5		HAZ. STRUCTURES	40 EA.	80
6		EXPLOSIVE HAZARD		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 THRU 7	255
9		POPULATION - 1 MILE		1
10	TARGETS	NEAREST RESIDENCE		0
11		RECREATIONAL USE		0
12		TARGETS SCORE	SUM LINES 9 THRU 11	1
13		**SITE SAFETY SCORE**	(LINES 1 x 8 x 12) / 1,000	**2.55**



07-174, #4: North end of WR-1



07-174, #5: Adit with sligh

07-174, #6: South end of WR-1

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY
SITE INVESTIGATION LOG SHEET

Mine/Site Name: HAYSTACK CREEK **PA#:** 07-179

Date: September 23, 1995 **Time:** 1210-1700

Field Team Leader: Tuesday, Pioneer

Sampling Personnel: Flammang, Pioneer
Sampson, Pioneer

Visitors: None

Weather/Seasonality Observations: Cool (40°F); partly cloudy; slight breeze.

Photographic Log (Photo No.'s/Video Tape Number)**:** #19: WR-1 from above; #20: Adit discharge (AD-1 sample location) from northeast; #21: WR-2 from road; #22: SW-1 sample location (Note: Waste rock in creek); #24: WR-3 at Upper Haystack. Video Tape No. 1

General Comments/Observations (not covered specifically in attached Inventory Forms)**:** Site is composed of lower site (WR-1 and WR-2) and upper site (WR-3). Upper site is approximately 1/2 mile upstream and up Haystack Creek Road from the lower site. A permanent hunting camp is set up across the road from WR-1.

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Move dumps from stream, cover, and revegetate. Lower adit discharge may require treatment.

I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): HAYSTACK CREEK **PA#:** 07-179

Legal Description: T 14N ;R 8E ;Sec. 16 , SW 1/4 NW 1/4 ____ 1/4

County: CASCADE **Mining District:** NEIHART

Latitude: N 46° 58' 42" **Longitude:** W 110° 43' 11"

Primary Drainage Basin and Code: Belt Creek/10030105
Secondary Drainage Basin: Haystack Creek/Carpenter Creek

USGS Quadrangle map name(s): Neihart

Mine Type/Commodities: Hardrock/Silver, Lead, Zinc
Activity Status: Active____, Inactive/Exploration____, Abandoned X .

Ownership status: Known Y X N____; private/public? Public
Owner, Agent, or Contact (Include address and phone when available):

Relationship to other mines/sites in the area/district: 1/2 mile west of the Baker and Vilipa Mines on MacKay Creek; north of Carpenter Creek Tailings site.

Regulatory Status (Activity by other agencies)? Hardrock permits? Past Reclamation Activities? Unknown

General site features: Elevation 6100';6240 , **Slope** 0-5° ,
Aspect Lower, east; Upper, west and south

Land use: Mining____, Recreational X , Residential____, Urban____, Agricultural____, Other(Specify)

Area of disturbed/unvegetated lands? 0.5 (upper); 1.4 (lower) **acre(s).**
Site Dimensions: 225 feet x 100 feet (upper); 200 feet x 300 feet (lower)

Predominant vegetation types: Lodgepole pine, grasses

Access: roads - good (paved)____, poor (maintained dirt road)____, 4wd X , trail____.
Other logistical considerations (proximity to other sites). Road is impassable approximately 150' below upper dump; Carpenter Creek Tailings is just before turnoff to Haystack Creek Road.

Well logs within 1 mile radius; (Attach MBMG Well Log Printout(s): There are 2 well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also note presence of radioactive minerals). Lower site lies on both sides of Haystack Creek, which flows south through the site. Haystack Creek flows into Carpenter Creek 0.25 mile downstream of lower site. Carpenter Creek flows southwest into Belt Creek 2.5 miles away. Site is underlain by Snow Creek gneiss and pinto diorite.

Mining/milling history, ore type/tenor, host rock, gangue: No information was found.

Mine Operation?

Shafts - Yes___, No_X_, # ____, Comment

Adits - Yes_X_, No___, # 3 , Comment 2 collapsed; 1 open

Pits - Yes___, No_X_, # ____, Comment

Placers - Yes___, No_X_, # ____, Comment

Other - Yes___, No_X_, # ____, Comment

Mill Operation? Yes____, No_X_. If yes answer the next three questions:

Period(s) of Operation: N/A

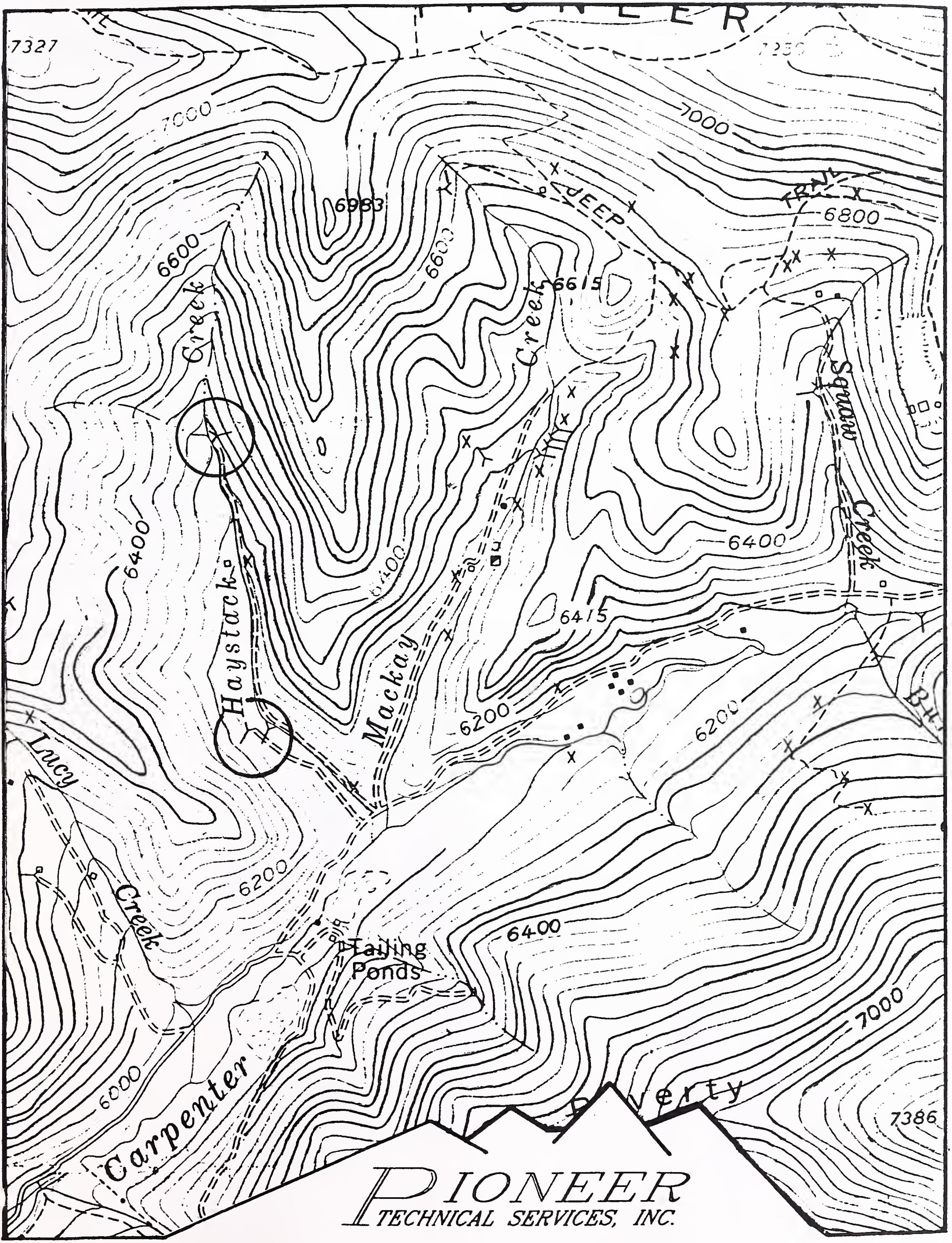
Origin of Ore Milled - Custom Mill___ Dedicated Mill___; Number and names of mines that supplied mill feed: N/A

Process? Hg-amalgam, CN⁻ leach (vat, heap), floatation, smelting?
N/A

Montana Bureau of Mines and Geology
Water Well Log Data

10/22/1993

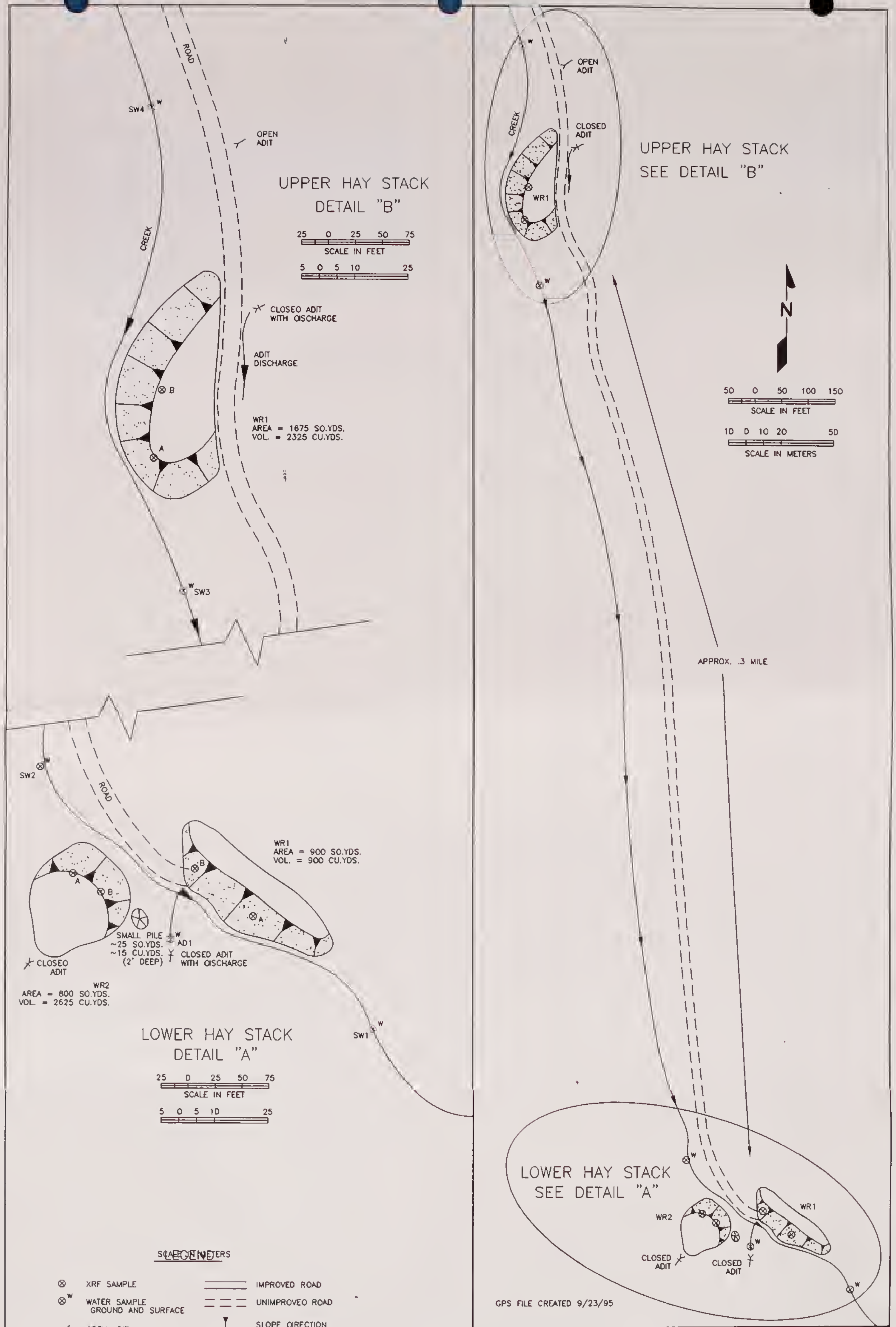
Well No.	Location	Depth	Yield	Static Water Level
M:123062	14N 08E 20 DBA	41.0	4.0	24.00
M:123061	14N 08E 20 DBA	40.0	7.0	0.00



HAYSTACK CREEK, P.A. NO. 07–179

T14N, R08E, SECTION 16

SCALE: 1" = 1000'



LEGEND

- ⊗ XRF SAMPLE
- ⊗ᵂ WATER SAMPLE GROUND AND SURFACE
- OPEN ADIT
- COLLAPSED ADIT
- DRAINAGE
- DRY DRAINAGE
- IMPROVED ROAD
- UNIMPROVED ROAD
- SLOPE DIRECTION
- WASTE ROCK DUMP OR TAILINGS PILE

DRAWN FOR:

PIONEER
TECHNICAL SERVICES, INC.
P.O. BOX 3445
BUTTE, MT 59702

TITLE:

HAY STACK CREEK
PA# 07-179

DRAWING NO.: PT342107
DATE: 1/29/96
PLOT SCALE: 1 = 50

II. INFORMATION COLLECTED ON SITE

A. SOLID MATRIX WASTE CHARACTERIZATION

1. **Waste Characteristics** - *Use table on following page.*

Unique source identification: (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TP); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures/vessels sound, are runon/runoff controls in place, are wastes covered or vegetated, pond liners intact?

2. **TAILINGS IMPOUNDMENTS** - *If tailings impoundments are also present, complete the following questions.*

Describe the tailings grain size distribution (approximate % sand, silt, & clay): N/A

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): N/A

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): N/A

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): N/A

Comments on potential for mitigation: N/A

SOURCE INVENTORY FORM

SAMPLERS: Flammang, Sampson

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd^3)	LOCATION/DESCRIPTION	CONTAIN-MENT	pH SU (D/S)*	RADIO-ACTIVITY (mR/HR)	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
WR-1A	WR	900	Lower site, lowest waste rock; east end, north side	None	6.6	0.06	07-179-WR-1	09/24/95 1200	T-Metals, ABA
WR-1B	WR		Lower site, lowest waste rock; west end, south side	None	7.0	0.08			
WR-2A	WR	2,625	Lower site, upper waste rock; north end, west side	None	6.2	0.09	07-179-WR-2	09/24/95 1210	T-Metals, ABA
WR-2B	WR		Lower site, upper waste rock; north end, east side	None	6.4	0.065			
WR-3A	WR	2,325	Upper site; south end, top of knob	None	6.2	0.04	07-179-WR-3	09/24/95 1210	T-Metals, ABA
WR-3B	WR		Upper site; west side	None	6.2	0.05			

* pH readings were taken directly on-site (Kelway Meter).

Comments or deviations from SOPs: 07-179-WR-1 is a composite of WR-1A and -1B. 07-179-WR-2 is a composite of WR-2A and -2B. 07-179-WR-3 is a composite of WR-3A and -3B. Background sample was collected at the Ripple Mine (07-163-SS-1) during the 1994 investigation.

B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes_X_, No___, Number:_2__ Identification:_AD-1, AD-2_

Filled shafts: Yes___, No_X_, Number:____ Identification:________

Seeps/Springs: Yes___, No_X_, Number:____ Identification:________

Groundwater wells within 4 miles?: Yes_X_, No___;
Number of well logs:_27___

Distance to nearest well used for drinking:
___<1,000 ft;___1,000 ft to 0.5 miles;_X_>0.5 miles.

Sample types: Flowing adits (AD); filled shafts (SH); Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?
Definite____, **Probable**_X__, **Possible**____, **Unlikely**____.
High metals and low pH in sources; shallow groundwater in floodplain of Haystack Creek

Approximate Depth to Groundwater:_X_<25 ft;___ 25 - 100 ft;___ >100 ft.

Other observations/notes:_N/A___

GROUNDWATER INVENTORY FORM

SAMPLERS: Tuesday, Flammang

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SOURCE	FLOW* cfs/gpm	pH SU	SC µS/cm @ 25°C	Eh mV	Temp °C	ALK. mg/L as $CaCO_3$	Depth ft	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
AD-1	AD	Lower collapsed adit at lower site	< 1 gpm (E)	3.16	513	250	5.6	0	N/A	07-179-AD-1	09/23/95 1330	T-Metals, TDS, Hardness, Cl, SO4
AD-2	AD	Collapsed adit at upper site	< 0.5 gpm (E)	5.59	448	208	6.6	0	N/A	N/A	N/A	Field paramters

FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): ____________________

C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map Indicate drainage patterns (run-on/run-off) and directions on sketch maps.

Flowing streams: Yes X, No ___, Name(s): Haystack Creek

Dry streambeds: Yes ___, No X, Name(s): ___

Other surface water: Yes X, No ___, Name(s)/Description: Adit discharge

Waste materials within any floodplain: Yes X, No ___ Source ID(s): WR-1, WR-2, and WR-3

Approximate Flood frequency? X 1 yr, ___10 yr, ___100 yr

Estimated seasonal flow of stream(s) (cfs/gpm)? 0.22 cfs (lower); 20 gpm (upper) **High Flow:** 0.4 cfs, **Average Flow:** 0.22 cfs

Distance between waste source(s) and nearest surface water body (ft)? 0 feet between WR-1, WR-2, and WR-3 and Haystack Creek

Surface water draining onto or through waste sources: Yes ___, No X, **Describe:** Run-off only

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?) Recreation, fishery, wetland in Belt Creek

Observed erosional/sedimentation/stream turbidity problems? Yes X, No ___. **Distance downstream (ft)?** 0-500 ___; 500-1,000 X; >1,000 ___. **Describe/explain** (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present): Sediment has elevated metals 500 feet downstream.

SURFACE WATER INVENTORY FORM

SAMPLERS: Tuesday, Flammang, Sampson

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SAMPLE LOCATION	pH SU	SC $\mu S/cm$ @ 25°C	Temp °C	ALK. mg/L as $CaCO_3$	Flow* cfs/gpm	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
SW-1	SW	Downstream of WR-1 approximately 80 feet	6.0	154	5.8	9	0.22 cfs (M)	07-179-SW-1	09/23/95 1240	T-Metals, TDS, Hardness, Cl, SO4
SE-1	SE	Downstream of WR-1 approximately 80 feet	N/A	N/A	N/A	N/A	N/A	07-179-SE-1	09/23/95 1240	T-Metals
SW-2	SW	40 feet upstream of WR-2	7.77	135	6.9	14	0.22 cfs (M)	07-179-SW-2	09/23/95 1350	T-Metals, TDS, Hardness, Cl, SO4
SE-2	SE	40 feet upstream of WR-2	N/A	N/A	N/A	N/A	N/A	07-179-SE-2	09/23/95 1350	T-Metals
SW-3	SW	30 feet downstream of WR-3	8.68	299	7.7	9	20 gpm (E)	07-179-SW-3	09/23/95 1600	T-Metals, TDS, Hardness, Cl, SO4
SE-3	SE	30 feet downstream of WR-3	N/A	N/A	N/a	N/A	N/A	07-179-SE-3	09/23/95 1630	T-Metals
SW-4	SW	20 feet upstream of open adit above WR-3	8.63	240	6.9	9.5	20 gpm (E)	07-179-SW-4	09/23/95 1630	T-Metals, TDS, Hardness, Cl, SO4
SE-4	SE	20 feet upstream of open adit above WR-3	N/A	N/A	N/A	N/A	N/A	07-179-SE-4	09/23/95 1630	T-Metals
SE-500	SE	500 feet downstream of SE-1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	XRF Analysis

*FLOW: Estimated (E) or Measured (M)?

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

AMD Characteristics:

Presence and abundance of sulfides?	*(SO_3)*
Presence of evaporative salt deposits?	*(ESD)*
Discolored or turbid seepage?	*(SPG)*
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	*(FEOX)*
Presence of burned or stressed vegetation?	*(VEG)*
$pH \leq 5.0$	*(pH)*

General Potential for AMD Mitigation:

Area available for treatment (acres)? Meadow to southwest of WR-3, approximately 10 acres

Wetlands present: Yes X **, No**___**, Describe:** Small wetlands on north side of creek near WR-1, below WR-1, and 30' x 8' small bog below WR-3.

Carbonate rocks/soils: Yes___**, No** X **, Describe:**___

E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10___**; 10-30**___**; 30-100** X **; 100-300**___**; 300-1,000**___**; 1,000-3,000**___**; 3,000-10,000**___**; 10,000 or greater**___**; Comments** Town of Neihart

Nearest residence:___**<1,000 ft;**___**1,000 ft - 0.5 miles;** X **>0.5 miles.**

For each source (table next page):

Available fine materials? Surface area?

Uncovered and unvegetated? Wet or dry?

Overall dust propagation potential:
observed high moderate low none

ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

SAMPLERS: Tuesday, Flammang, Sampson

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LIST)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/HIGH/MODERATE/LOW/NONE)
WR-1	SO3; FEOX	Dry	8,100	8,100	Yes	Low
WR-2	Minor SO3; FEOX	Dry	7,200	7,200	Yes	Low
WR-3	Minor SO3; FEOX	Dry	15,075	13,570	Yes	Low
AD-1	pH; algae	N/A	N/A	N/A	N/A	N/A
AD-2	Algae	N/A	N/A	N/A	N/A	N/A

Notes and Clarifications:

F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes_____, No_X_,
Describe:____

Population within 1 mile: 1-10_X_; 10-30___; 30-100___; 100-300___; 300-1,000___; 1,000-3,000___; 3,000-10,000___; 10,000 or greater___;
Comments____

Evidence of recreational use on site: Yes_X_, No___, Describe:_______
Campfire residue on WR-1; gun shells; litter on all dumps; permanent hunting camp directly across from WR-1 and WR-2.

Accessibility (check each that apply):_X_Easily accessible - no fences, gates, or warning signs;___Moderately Accessible - barbed wire fences, road gated, or signs posted;___Difficult Access - chain-link fence, road gated and locked, site guarded (does not include locked or manned access points located more than 0.5 miles from the actual site).

Sensitive environments on-site or adjacent to site:

State or National Parks -	Yes___,	No_X_,	Comment_____________
Wilderness Area -	Yes___,	No_X_,	Comment_____________
T&E Species Habitat -	Yes___,	No_X_,	Comment_____________
Bat Habitat -	Yes_X_,	No___,	Comment Possible, open adit

Primary Drainage___; Secondary Drainage_X_; No Information___:

Riparian Habitat Quality -	High___,	Medium_X_,	Low___
Wetlands Frontage -	High___,	Medium___,	Low_X_

Fisheries Habitat and Species Classification - _6_
Sport Fishery Classification - _6_

G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes_X_, No___, Number_1_, types and locations:___
Open adit (AD-3) at upper site

Hazardous structures: Yes___, No_X_, Number_____, types and locations:_

Unstable highwalls, pits, trenches, slopes: Yes_X_, No___, Number_2_, types and locations: Small unstable slopes associated with collapsed AD-1 and AD-2

Unstable waste piles, impoundments, undercut banks: Yes_X_, No_____, Number_1_, types and locations: WR-2 has steep slopes at angle of repose, approximately 20 feet high.

Fire and/or Explosion hazards: Yes___, No_X_, Explain:_______________

Bibliography

MBMG, Geology and Ore Deposits of the Neihart Mining District, Cascade County, Montana, Memoir 13, Written by Paul A. Schafer, July 1935.

MBMG, Well Log Database, July 14, 1994.

MDFWP, Montana Rivers Information System Rivers Report, Prepared by Montana Natural Resource Information System, July 1995.

MDHES/SHWB, Superfund Basics, Overview and Accomplishments of Superfund in Montana 1983-1993, November 1993.

MDEQ/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for Haystack Creek Mine, Prepared by Chen-Northern, October 31, 1989.

MDEQ/AMRB Files, Hazardous Materials Inventory Site Investigation Log Sheet for Carpenter Creek Tailings, Prepared by Pioneer Technical Services, Inc., May 24 and 25, 1993.

USBM, Mines and Mineral Deposits (Except Fuels), Cascade County, Montana, Information Circular No. 7589, Written by Almon F. Robertson, April 1950.

USGS, Topographic Map, Neihart, Montana, 7 1/2 minute Quadrangle, 1961.

LABORATORY ANALYTICAL DATA

HAYSTACK CREEK
PA NO. 07-179

Haystack Creek PA# 07-179
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/23/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
07-179-SE-1	6.9 UJ	5.8 UJ	124	10.0	2560	5.4	58.6	168	25100	674 JX	5980 J	2700	0.081	16.2	1.1 U	896	NR
07-179-SE-2	5.9 UJ	5.0 UJ	123	0.85	1440	13.5	17.4	59.5	15900	81.1 JX	3560 J	940	0.042 U	13.1	.1.0 U	213	NR
07-179-SE-3	5 7 UJ	9.4 J	142	4.4	2300	10.8	18.7	158	27900	310 JX	4180 J	859	0.050	11.1	0.75 U	870	NR
07-179-SE-4	5.7 UJ	6.5 J	144	2.5	1680	16.5	23.3	115	26700	175 JX	4370 J	1150	0.043 U	18.1	0.78 U	278	NR
07-179-WR-1	5.1 UJ	4.3 UJ	15.6	4.7	654	1.6 U	1.8 U	17.6	3820	1680 JX	935 J	15.3	0.73	2.6	1.3	1010	NR
07-179-WR-2	9.6 J	45.4 J	83.4	4.9	2260	3.7	3.3	98.6	27600	2800 JX	6420 J	148	0.40	7.0	3.5	1250	NR
07-179-WR-3	6.2 UJ	25.9 J	204	1.5	2320	11.3	9.9	261	43900	589 JX	9800 J	423	0.53	6.7	1.4	328	NR
BACKGROUND	4.7 UJ	9.6	87.6	1.32 JX	NR	27.2 J	9.05 J	10.8 J	21100	52.4 JX	NR	708 J	0.04	10.3	0.5 B	135	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potentisl Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
07-179-WR-1	0.12	3.75	-0.07	-3.82	0.07	0.03	0.02	0.94	-1.01	-1.01	-2.12	3.20	-4.09	-8.59
07-179-WR-2	0.34	10.6	3.95	-6.67	0.20	0.06	0.08	1.87	2.08	2.08	4.37	9.06	-6.39	-13.42
07-179-WR-2 DUP	0.35	10.9	4.05	-6.89	0.19	0.07	0.09	2.19	1.86	1.86	3.91	9.45	-6.75	-14.18
07-179-WR-3	0 47	14.7	-0.24	-14.9	0.32	0.06	0.09	1.87	-2.12	-2.12	-4.45	12.19	-15.54	-32.62

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Al (ug/L)	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
07-179-SW-1	94.4 JX	2.7 UJ	1.2 U	10.0	1.6	16500	9.6 U	10.9 U	6.6	313	4.2	2690	129	0.16 U	13.9 U	0.23	329	52 2
07-179-SW-2	78.4 JX	2.7 UJ	1.2 U	10.6	0.21	15200	9.6 U	10.9 U	7.0	319	0.61	2650	77.7	0.16 U	13 9 U	0.26	60 8	48 9
07-179-SW-3	249 JX	2.7 UJ	1.2 U	13.7	0.27	11100	9.6 U	10.9 U	14.0	1650	2.4	2390	126	0.16 U	13.9 U	0.29	77.4	37.5
07-179-SW-4	59.1 JX	2.7 UJ	1.2 U	10.7	0.20	10100	9.6 U	10.9 U	5.9	138	3.6	2210	23.6	0.16 U	13.9 U	0.21 U	49.9	34 2
07-179-AD-1	1710 JX	2.7 UJ	1.2 U	12.3	30.3	48100	9.6 U	29.5	68.9	4070	119	4720	1110	0.16 U	28.1	0.21 U	4980	140

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
07-179-SW-1	124	< 5	43	NR	NR
07-179-SW-2	117	< 5	36	NR	NR
07-179-SW-3	109	< 5	39	NR	NR
07-179-SW-4	216	< 5	29	NR	NR
07-179-AD-1	338	< 5	181	NR	NR

Legend

SE-1- 80 feet downstream of WR-1.
SE-2- 40 feet upstream of WR-2.
SE-3- 30' downstream of WR-3.
SE-4- 20' upstream of open adit above WR-3.
WR-1- Composite WR1A, WR1B.
WR-2- Composite WR2A, WR2B.
WR-3- Composite WR3A, WR3B.
BACKGROUND- From the Ripple (07-163-SS1) (1994 data).
AD-1- Lower collapsed adit at lower site.
SW-1- Same as SE-1.
SW-2- Same as SE-2.
SW-3- Same as SE-3.
SW4- Same as SE-4.

XRF ANALYSIS RESULTS

HAYSTACK CREEK
PA NO. 07-179

MDEQ AMRB/PIONEER 1/12/96

Mine Name: Haystack Creek PA No. 07-179
XRF Field Analyses
Results in PPM

XRF SAMPLE I.D.	CrHI	K	Ca	Tl	CrLO	Mn	Fe	Co	Ni	Cu	Zn	As	Se
07-179-WR1A		25870	3894.2	810.78			11579				421.28		
07-179-WR1B		28862	1380.8				7710.5				441.27		
07-179-WR2A		23459	3670.2	2222.9			56914	845.45 *		86.866 *	1252.9		
07-179-WR2B		22775	3920.2	2424.1			30842	490.83 *		74.314 *	1325.1		
07-179-WR3A		16031	8799.8	5064.4			65401	827.65 *		182.53 *	302.32		26.696 *
07-179-WR3B		23447	8065.1	4550.9		864.26 *	67284	718.12 *		337.74	388.24		
07-179-SED500		9809	8418.5	1452		5737.4	30633	355.11 *		225.29 *	1042.8		
07-179-WR1-COMP		25955	2803	494.85 *			8421.7	244.3 *			425.62		
07-179-WR2-COMP		22759	4051.1	2378.1			49726	647.63 *		159.52 *	1931.4		
07-179-WR3-COMP		18135	7453	3473.6		910.48 *	59511	883.35 *		283.64 *	324.56		

XRF SAMPLE I.D.	Sr	Zr	Mo	Hg	Pb	Rb	Cd	Sn	Sb	Ba	Ag	U	Th
07-179-WR1A	96.894	81.744	560.92		1547	208.88				319.55	108.17 *	30.728 *	43.089 *
07-179-WR1B	43.953	87.315	574.15		1161	172.39				207.64	85.241 *	48.537 *	61.232
07-179-WR2A	128.14	171.9	1598.6		2409.8	347.92				627.52	148.64 *		33.924 *
07-179-WR2B	132.65	119.84	1705.2		2714.6	339.81				527.84	99.953 *		47.309 *
07-179-WR3A	365.6	111.63	186.95		473.48	177.5				304.67	182.63 *		
07-179-WR3B	393.45	104.49	188.5		812.08	294.66				616.84	152.53 *		
07-179-SED500	336.9	122.29	237.15		234	156.64				931.43	96.674 *		31.563 *
07-179-WR1-COMP	74.62	91.657	561.04		1197.7	196.29				303.47	135.6 *	38.223 *	52.969
07-179-WR2-COMP	127.6	133.76	1592		2693.3	338.4				659.41	107.73 *		35.255 *
07-179-WR3-COMP	344.9	97.849	181.84		514.69	220.83				414.25	140.7 *		10.409 *

ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS) SCORESHEET

HAYSTACK CREEK
PA NO. 07-179

AIMSS SCORESHEET

SITE NAME: HAYSTACK CREEK
PA NUMBER: 07-179

LINE NO.				
		GROUNDWATER PATHWAY		
1	GW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A		CONTAINMENT		20
3B		GW DEPTH		20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	400
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	400
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	4.009
6	GW - TARGETS	WELLS - 1 MI. x 2.5		5.0
7		WELLS - 1 TO 4 MI		25
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	30.0
10		**GROUNDWATER SCORE**	LINES 4 x 5 x 9	48108
		SURFACE WATER PATHWAY		
11	SW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		300
12		EXCEEDENCES		50
13A		CONTAINMENT		20
13B		DISTANCE TO SW		20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	400
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	750
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	4.433
16	SW - TARGETS	DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		1
18		WETLANDS		10
19		FISHERY		5
20		RECREATION		5
21		IRRIGATION/STOCK		0
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 THRU 22	21
24		**SURFACE WATER SCORE**	LINES 14 x 15 x 23	69820
		AIR PATHWAY		
25	AIR - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
26A		CONTAINMENT		10
26B		DISTANCE TO POPULATION		5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	50
27		LIKELIHOOD SCORE	LINES 25 + 26C	50
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.124
29	AIR - TARGETS	POPULATION - 4 MILES		30
30		NEAREST RESIDENCE		0
31		WETLANDS		0
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 THRU 33	30
35		**AIR PATHWAY SCORE**	LINES 27 x 28 x 34	186
		DIRECT CONTACT PATHWAY		
36	LIKELIHOOD OF EXPOSURE	OBSERVED EXPOSURE		50
37A		ACCESSIBILITY		20
37B		DISTANCE TO POPULATION		5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	100
38		LIKELIHOOD SCORE	LINES 36 + 37C	150
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.111
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE		1
41		NEAREST RESIDENCE		0
42		RECREATIONAL USE		10
43		TARGETS SCORE	SUM LINES 40 THRU 42	11
44		**DIRECT CONTACT SCORE**	LINES 38 x 39 x 43	183
45	**TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE** (LINES 10 + 24 + 35 + 44) / 100,000			**1.18**

SITE NAME: HAYSTACK CREEK
PA NUMBER: 07-179

LINE NO.		SITE SAFETY		
1	THREAT	ACCESSIBILITY		20
2		OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	50
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	150
5		HAZ. STRUCTURES	40 EA.	0
6		EXPLOSIVE HAZARD		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 THRU 7	200
9		POPULATION - 1 MILE		1
10	TARGETS	NEAREST RESIDENCE		0
11		RECREATIONAL USE		10
12		TARGETS SCORE	SUM LINES 9 THRU 11	11
13		**SITE SAFETY SCORE**	(LINES 1 x 8 x 12) / 1,000	**44.00**

[illegible]

07-179, #19: Adit discharge from northeast

07-179, #20: WR-2 from road

07-179, #21: SW-1 sample location (Note: Waste rock in creek)

07/179, #23: WR-3 at Upper Haystack

GRANITE

COMBINATION

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY
SITE INVESTIGATION LOG SHEET

Mine/Site Name: COMBINATION II **PA#:** 20-009A

Date: October 19, 1995 **Time:** 1000-1600

Field Team Leader: Tuesday, Pioneer

Sampling Personnel: Bisch, Flammang, Pioneer

Visitors: None

Weather/Seasonality Observations: Cool; clear; sunny.

Photographic Log (Photo No.'s/Video Tape Number)**:** No photos were taken.
Video Tape No. 1

General Comments/Observations (not covered specifically in attached Inventory Forms)**:** Floodplain tailings extend north from the Combination Millsite at least 2 miles downstream. A location 1 mile north appears to have had a Hg-amalgamation unit (portable) to process the tailings in the floodplain. This location has a large areal extent of tailings deposition due to a widening of the floodplain and a reduction in stream gradient. Same contaminants and relative concentrations as Combination tailings.

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Grade larger tailings away from stream or remove to tailings pond at Combination Millsite (upstream). Amend and revegetate bare areas of tailings.

I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): COMBINATION II **PA#:** 20-009A

Legal Description: T 8N ;R 14W ;Sec. 6 , E 1/2 ____1/4 ____1/4
;Sec. 7 , NE 1/4 ____1/4 ____1/4

County: Granite **Mining District:** Combination

Latitude: N 46° 28' 00" **Longitude:** W 113° 23' 30"

Primary Drainage Basin and Code: Flint Creek/17010202
Secondary Drainage Basin: South Fork Lower Willow Creek
USGS Quadrangle map name(s): Black Pine Ridge

Mine Type/Commodities: Millsite/Gold
Activity Status: **Active**___, **Inactive/Exploration**___, **Abandoned** X .

Ownership status: Known Y X **N**___; **private/public?** Mainly public
Owner, Agent, or Contact (Include address and phone when available)**:** Deerlodge National Forest; ASARCO, Inc., owns Combination Mill and upper part, 180 Maiden Lane, New York, NY 10038.

Relationship to other mines/sites in the area/district: Downstream (north) of the Combination Millsite

Regulatory Status (Activity by other agencies)? Hardrock permits? Past Reclamation Activities? Some reclamation activity on-going at the original Combination Millsite in conjunction with the USFS.

General site features: Elevation 5400'-5600' , **Slope** 5° ,
Aspect North

Land use: Mining___, **Recreational** X , **Residential**___, **Urban**___,
Agricultural X , **Other(Specify)**___

Area of disturbed/unvegetated lands? Approx. 5 **acre(s).**
Site Dimensions: Streamside for 2 miles, varies in average width from 55 feet to 400 feet

Predominant vegetation types: Willows/grasses in floodplain; Lodgepole pine on slopes.

Access: roads - good (paved)___, **poor (maintained dirt road)**___,
4wd X , **trail**___.
Other logistical considerations (proximity to other sites). Downstream from Combination Millsite

Well logs within 1 mile radius; (Attach MBMG Well Log Printout(s): There is 1 well log within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also note presence of radioactive minerals). This "site" contains floodplain tailings that originated from the Combination Mills. Geologic setting is Quaternary alluvial sediments. Site is in South Fork Lower Willow Creek floodplain, which joins Flint Creek 12 miles downstream (north).

Mining/milling history, ore type/tenor, host rock, gangue: Combination Mills operated from 1887 to 1897 and from 1928 to unknown; mill was reported as a 10-stamp. Downstream at "site" unknown operator appears to have reprocessed floodplain tailings with a small (6' x 12') portable amalamation mill.

Mine Operation?
Shafts - **Yes**___, **No** X, **#** ____, **Comment**
Adits - **Yes**___, **No** X, **#** ____, **Comment**
Pits - **Yes**___, **No** X, **#** ____, **Comment**
Placers - **Yes**___, **No** X, **#** ____, **Comment**
Other - **Yes**___, **No** X, **#** ____, **Comment**

Mill Operation? **Yes** X, **No**____. **If yes answer the next three questions:**

Period(s) of Operation: Unknown

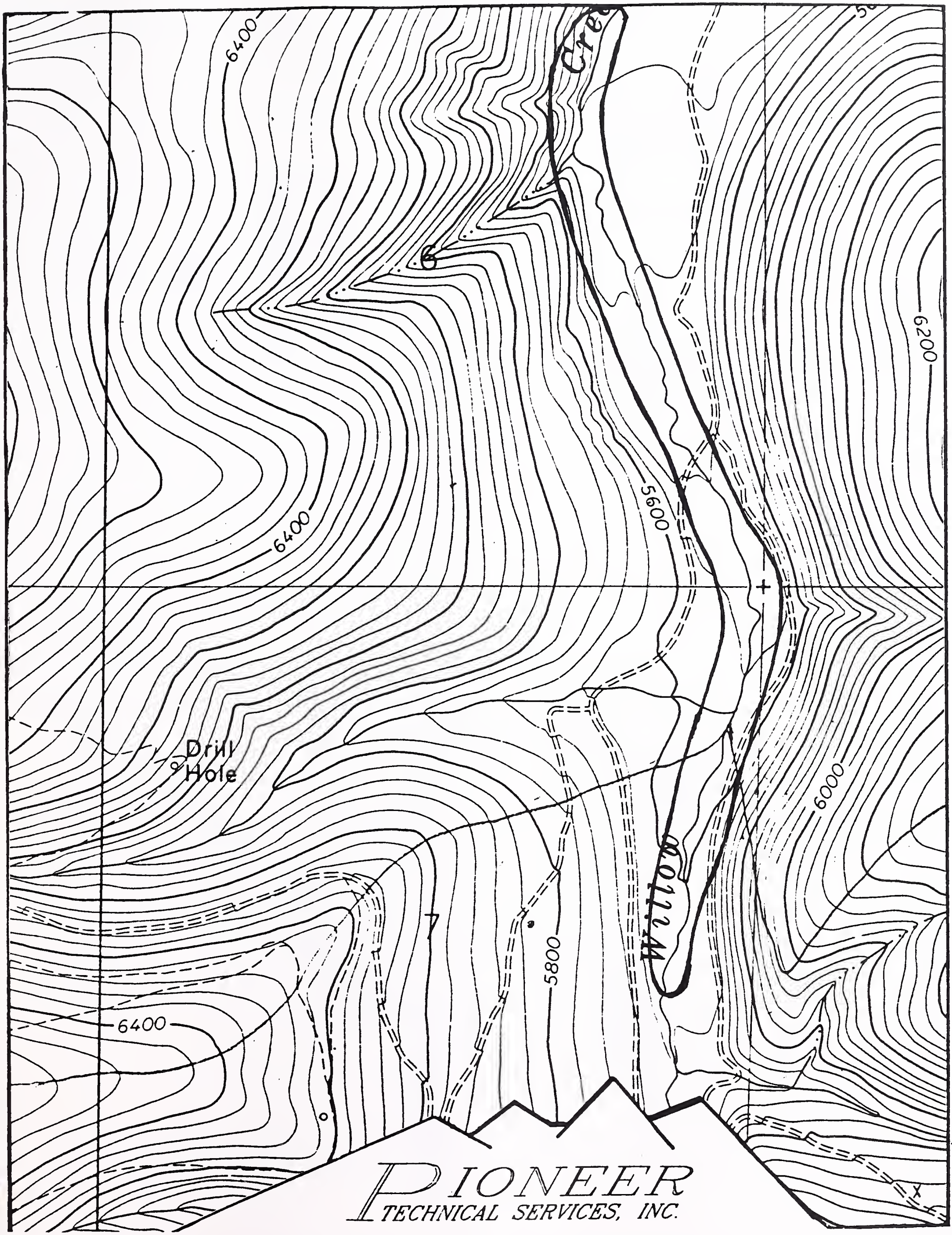
Origin of Ore Milled - Custom Mill X **Dedicated Mill**___; **Number and names of mines that supplied mill feed:** Combination Mill floodplain tailings

Process? Hg-amalgam, CN$^-$ leach (vat, heap), floatation, smelting?
Reprocess of floodplain tailings by Hg-amalgam

Montana Bureau of Mines and Geology
Water Well Log Data

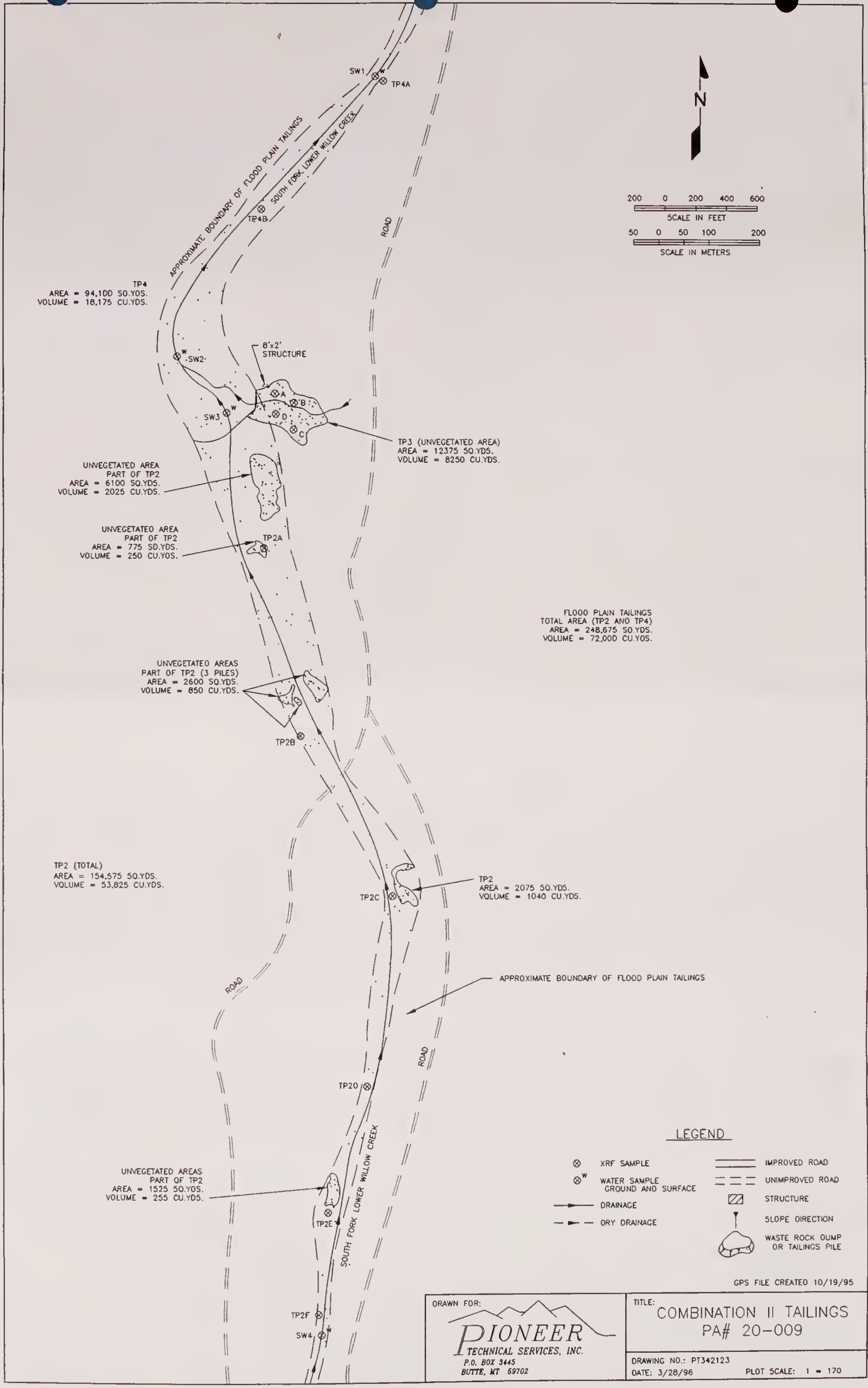
11/05/1993

Well No.	Location	Depth	Yield	Static Water Level
M:57488	08N 14W 07 DDD	60.0	60.0	20.00



PIONEER
TECHNICAL SERVICES, INC.

COMBINATION II, P.A. NO. 20-009A
T08N, R14W, SECTION 6 & 7
SCALE: 1" = 1000'



DRAWN FOR:
PIONEER
TECHNICAL SERVICES, INC.
P.O. BOX 3445
BUTTE, MT 59702

TITLE:
COMBINATION II TAILINGS
PA# 20–009

DRAWING NO.: PT342123
DATE: 3/28/96
PLOT SCALE: 1 = 170

II. INFORMATION COLLECTED ON SITE

A. SOLID MATRIX WASTE CHARACTERIZATION

1. **Waste Characteristics** - *Use table on following page.*

Unique source identification: (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TP); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures/vessels sound, are runon/runoff controls in place, are wastes covered or vegetated, pond liners intact?

2. **TAILINGS IMPOUNDMENTS** - *If tailings impoundments are also present, complete the following questions.*

Describe the tailings grain size distribution (approximate % sand, silt, & clay): No impoundments; floodplain alluvial deposition 70% sand and 30% silt.

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): Range from 0.25' to 1.5' deep; average depth is approximately 1'.

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): Dry

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): No impoundment; tailings are gone where stream is active.

Comments on potential for mitigation: Most tailings seem to be self-revegetating. In large depositional areas tailings need nutrients and/or other grain sizes to establish vegetation.

SOURCE INVENTORY FORM

SAMPLERS: Tuesday

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd^3)	LOCATION/DESCRIPTION	CONTAIN-MENT	pH SU (D/S)*	RADIO-ACTIVITY (mR/HR)	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
TP-2A	TAIL	53,825	Tailings above portable mill and below Combination Mill; 5,000 feet	None	6.8	0.03	20-009-TP-2	10/24/95 1200	T-Metals, ABA, Cyanide
TP-2B	TAIL		Tailings above portable mill and below Combination Mill; 4,000 feet	None	6.7	0.02			
TP-2C	TAIL		Tailings above portable mill and below Combination Mill; 3,000 feet	None	6.9	0.03			
TP-2D	TAIL		Tailings above portable mill and below Combination Mill; 2,000 feet	None	6.4	0.03			
TP-2E	TAIL		Tailings above portable mill and below Combination Mill; 1,000 feet	None	6.9	0.04			
TP-2F	TAIL		Tailings just below Combination Mill	None	6.8	0.03			
TP-3A	TAIL	8,250	Tailings at portable mill; 6,000 feet, northwest part	None	6.8	0.03	20-009-TP-3	10/24/95 1200	T-Metals, ABA, Cyanide
TP-3B	TAIL		Tailings at portable mill; 6,000 feet; northeast part	None	6.6	0.03			
TP-3C	TAIL		Tailings at portable mill; 5,500 feet, southeast part	None	6.4	0.03			
TP-3D	TAIL		Floodplain tailings at portable mill; 5,500 feet, southwest part	None	6.8	0.03			
TP-4A	TAIL	18,175	Floodplain tailings below portable mill; 8,000 feet	None	6.2	0.03	N/A	N/A	XRF Analysis
TP-4B	TAIL		Floodplain tailings below portable mill; 7,000 feet	None	6.6	0.03	20-009-TP-4	10/24/95 1200	T-Metals, ABA, Cyanide

* pH readings were taken directly on-site (Kelway Meter).

Comments or deviations from SOPs: 20-009-TP-2 is a composite of TP-2A through -2F. 20-009-TP-3 is a composite of TP-3A through -3D. 20-009-TP-4 is TP-4B. Background sample was collected from the Combination (20-009-SS-1) during the 1993 investigation.

B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes___, No X, Number:____ Identification:____

Filled shafts: Yes___, No X, Number:____ Identification:____

Seeps/Springs: Yes___, No X, Number:____ Identification:____

Groundwater wells within 4 miles?: Yes X, No___;
Number of well logs: 1

Distance to nearest well used for drinking:
___<1,000 ft;___1,000 ft to 0.5 miles; X >0.5 miles.

Sample types: Flowing adits (AD); filled shafts (SH); Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?
Definite____, Probable____, Possible X, Unlikely____.
Floodplain tailings; shallow groundwater in alluvium.

Approximate Depth to Groundwater: X <25 ft;___ 25 - 100 ft;___ >100 ft.

Other observations/notes: N/A

GROUNDWATER INVENTORY FORM

SAMPLERS: ____________________

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SOURCE	FLOW* cfs/gpm	pH SU	SC $\mu S/cm$ @ 25°C	Eh mV	Temp °C	ALK. mg/L as $CaCO_3$	Depth ft	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
No samples were taken.												

FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): ____________________

C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map Indicate drainage patterns (run-on/run-off) and directions on sketch maps.

Flowing streams: Yes X, No ___, Name(s): South Fork Lower Willow Creek

Dry streambeds: Yes ___, No X, Name(s): ___

Other surface water: Yes ___, No X, Name(s)/Description: ___

Waste materials within any floodplain: Yes X, No ___ Source ID(s): TP-2, TP-3, and TP-4

Approximate Flood frequency? X 1 yr, ___ 10 yr, ___ 100 yr

Estimated seasonal flow of stream(s) (cfs/gpm)? 10 cfs

High Flow: 50 cfs, **Average Flow:** 10 cfs

Distance between waste source(s) and nearest surface water body (ft)? 0 feet

Surface water draining onto or through waste sources: Yes X, No ___,

Describe: Creek flows through floodplain tailings.

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)

Wetlands; agriculture; fishery

Observed erosional/sedimentation/stream turbidity problems? Yes X, No ___. **Distance downstream (ft)?** 0-500 ___; 500-1,000 ___; >1,000 X. **Describe/explain** (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present): Tailings are still evident in stream banks 2 miles downstream.

SURFACE WATER INVENTORY FORM

SAMPLERS: Bisch

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SAMPLE LOCATION	pH SU	SC µS/cm @ 25°C	Temp °C	ALK. mg/L as $CaCO_3$	Flow* cfs/gpm	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
SW-1	SW	2 miles downstream of Combination Mill in South Fork Lower Willow Creek at USFS/private boundary (Sec. 6)	7.95	61	2.3	59	12 cfs (E)	20-009-SW-1	10/18/95 0955	T-Metals, TDS, Hardness, Cl, SO4
SE-1	SE	2 miles downstream of Combination Mill in South Fork Lower Willow Creek at USFS/private boundary (Sec. 6)	N/A	N/A	N/A	N/A	N/A	20-009-SE-1	10/18/95 0955	T-Metals
SW-2	SW	Below Hg-amalgam mill in South Fork Lower Willow Creek; 6,000 feet downstream from Combination Mill	8.15	50	3.8	11	10 cfs (E)	20-009-SW-2	10/18/95 1045	T-Metals, TDS, Hardness, Cl, SO4
SE-2	SE	Below Hg-amalgam mill in South Fork Lower Willow Creek; 6,000 feet downstream from Combination Mill	N/A	N/A	N/A	N/A	N/A	20-009-SE-2	10/18/95 1045	T-Metals
SW-3	SW	Above Hg-amalgam mill in South Fork Lower Willow Creek; 5,500 feet downstream from Combination Mill	8.11	52	4.3	11	10 cfs (E)	20-009-SW-3	10/18/95 1045	T-Metals, TDS, Hardness, Cl, SO4
SE-3	SE	Above Hg-amalgam mill in South Fork Lower Willow Creek; 5,500 feet downstream from Combination Mill	N/A	N/A	N/A	N/A	N/A	20-009-SE-3	10/18/95 1105	T-Metals
SW-4	SW	Just below Combination Mill in South Fork Lower Willow Creek	8.51	47	7.5	14	10 cfs (E)	20-009-SW-4	10/18/95 1355	T-Metals, TDS, Hardness, Cl, SO4
SE-4	SE	Just below Combination Mill in South Fork Lower Willow Creek	N/A	N/A	N/A	N/A	N/A	20-009-SE-4	10/18/95 1355	T-Metals

*FLOW: Estimated (E) or Measured (M)?

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

AMD Characteristics:

Presence and abundance of sulfides? *(SO_3)*

Presence of evaporative salt deposits? *(ESD)*

Discolored or turbid seepage? *(SPG)*

Presence of long filamentous algae in drainages, mosses in moist areas?

Presence of ferric hydroxide precipitates? *(FEOX)*

Presence of burned or stressed vegetation? *(VEG)*

pH ≤ 5.0 *(pH)*

General Potential for AMD Mitigation:

Area available for treatment (acres)? 20 acres or more in floodplain

Wetlands present: Yes X **, No** ___ **, Describe:** Several places in creek down from mill

Carbonate rocks/soils: Yes ___ **, No** X **, Describe:** ___

E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10 X **; 10-30** ___ **; 30-100** ___ **; 100-300** ___ **; 300-1,000** ___ **; 1,000-3,000** ___ **; 3,000-10,000** ___ **; 10,000 or greater** ___ **; Comments** ___

Nearest residence: ___ **<1,000 ft;** ___ **1,000 ft - 0.5 miles;** X **>0.5 miles.**

For each source (table next page):

Available fine materials? *Surface area?*

Uncovered and unvegetated? *Wet or dry?*

Overall dust propagation potential:
observed *high* *moderate* *low* *none*

ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

SAMPLERS: Tuesday

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LIST)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/HIGH/MODERATE/LOW/NONE)
TP-2	FEOX	Dry	1,391,175	436,050	Yes	Low
TP-3	FEOX	Dry	111,375	111,375	Yes	Low
TP-4	FEOX	Dry	846,900	211,725	Yes	Low

Notes and Clarifications:

F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes____, No_X_
Describe:__________

Population within 1 mile: 1-10_X_; 10-30___; 30-100___; 100-300___; 300-1,000___; 1,000-3,000___; 3,000-10,000___; 10,000 or greater___;
Comments_None_

Evidence of recreational use on site: Yes_X_, No___, Describe:_Camp remains; 4-wheeler tracks_

Accessibility (check each that apply):_X_Easily accessible - no fences, gates, or warning signs;___Moderately Accessible - barbed wire fences, road gated, or signs posted;___Difficult Access - chain-link fence, road gated and locked, site guarded (does not include locked or manned access points located more than 0.5 miles from the actual site).

Sensitive environments on-site or adjacent to site:

State or National Parks -	Yes___,	No_X_,	Comment___
Wilderness Area -	Yes___,	No_X_,	Comment___
T&E Species Habitat -	Yes_X_,	No___,	Comment_Bald eagle_
Bat Habitat -	Yes___,	No_X_,	Comment___

Primary Drainage_X_; Secondary Drainage___; No Information___:
Riparian Habitat Quality - High___, Medium_X_, Low___
Wetlands Frontage - High___, Medium_X_, Low___
Fisheries Habitat and Species Classification - _4_
Sport Fishery Classification - _3_

G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes___, No_X_, Number____, types and locations:___

Hazardous structures: Yes___, No_X_, Number____, types and locations:_

Unstable highwalls, pits, trenches, slopes: Yes___, No_X_, Number____, types and locations:___

Unstable waste piles, impoundments, undercut banks: Yes_X_, No____, Number_____, types and locations:_Tailings bank undercut in several locations._

Fire and/or Explosion hazards: Yes___, No_X_, Explain:___

Bibliography

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MDEQ/AMRB Files, Hazardous Materials Inventory Site Investigation Log Sheet for Combination Millsite, Prepared by Pioneer Technical Services, Inc., July 21, 1993.

MDEQ/AMRB Files, Letter to Ed Gensler from Bob Wintergerst, Deerlodge National Forest, Regarding Material for the Combination Mining/Milling Site in Granite County, September 14, 1987.

MDEQ/WQB Files, Analytical Data for Combination Millsite, June 2, 1977, July 13 and 20, 1978, and August 18, 1978.

USGS, Topographic Map, Black Pine Ridge, Montana, 7 1/2 minute Quadrangle, 1971.

Wintergerst, Bob, Personal Communication and Photos, 1995.

LABORATORY ANALYTICAL DATA

COMBINATION II
PA NO. 20-009

Combination II Tailings PA# 20-009
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 10/19/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
20-009-SE-1	98.1 JX	266 JX	518 J	16.6 J	2320	13.8 J	19.0	1270 JX	17200 JX	1600 JX	3210	784 JX	46.7	14.5	26.3 JX	522 J	NR
20-009-SE-2	64.5 JX	258 JX	340 J	9.1 J	1520	7.7 J	15.1	1060 JX	13600 JX	1550 JX	1700	1070 JX	24.7	5.4	23.2 JX	268 J	NR
20-009-SE-3	79.3 JX	223 JX	460 J	12.1 J	2150	8.6 J	15.0	1220 JX	15800 JX	1450 JX	2870	707 JX	43.0	18.3	18.8 JX	394 J	NR
20-009-SE-4	26.7 JX	117 JX	361 J	5.6 J	1950	8.8 J	8.7	582 JX	11800 JX	769 JX	2190	639 JX	14.3	8.1	9.7 JX	157 J	NR
20-009-TP2	229 JX	652 JX	320 J	15.9 J	132	2.2 J	3.2	1910 JX	10700 JX	3910 JX	287	357 JX	122	2.3 U	65.0 JX	353 J	0.666
20-009-TP3	447 JX	1230 JX	400 J	36.4 J	123	2.3 UJ	2.6 U	4400 JX	12500 JX	7620 JX	40.5	91.5 JX	70.5	3.3 U	110 JX	220 J	1.49
20-009-TP4	485 JX	1490 JX	716 J	39.5 J	353	2.4 UJ	2.7 U	5020 JX	14700 JX	9000 JX	189	181 JX	282	3.5 U	108 JX	317 J	0.313
BACKGROUND	33.3	76.3	329	2	NR	6.06	6.18	116	11700	85.8	NR	1530 J	1.33 J	6.77	NR	47.4	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Bese Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
20-009-TP2	0.06	1.87	0.8	-1.07	0.04	0.01	0.01	0.31	0.49	0.49	1.03	1.56	-0.95	-2.00
20-009-TP3	0.16	5	1.07	-3.93	0.15	<0.01	0.01	0	1.07	1.07	2.25	3.83	-3.45	-7.24
20-009-TP4	0.09	2.81	1.05	-1.77	0.08	<0.01	0.01	0	1.05	1.05	2.20	2.19	-1.42	-2.99

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
20-009-SW-1	9.3	2.7	61.5	0.20	3240	8.7 U	8.3 U	23.6 J	84.0 J	2.7	1940	15.7 J	0.48 JX	16.9 U	0.52 JX	26.1	16.1
20-009-SW-2	8.8	2.5	54.4	0.16	3010	8.7 U	8.3 U	25.0 J	172 J	4.0	1820	16.8 J	0.50 JX	16.9 U	0.21 UJX	29.4	15.0
20-009-SW-3	5.8	1.8	53.5	0.16	3100	8.7 U	8.3 U	24.0 J	153 J	3.0	1810	17.9 J	0.46 JX	16.9 U	0.57 JX	22.8	15.2
20-009-SW-4	2.4	1.5 U	63.5	0.068	3370	8.7 U	8.3 U	16.5 J	160 J	1.0	1760	17.9 J	0.22 JX	16.9 U	0.48 JX	9.1 U	15.7

U- Not Detected; J- Estimated Quantity; X- Outlier for Accurecy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
20-009-SW-1	46	< 5	10	NR	NR
20-009-SW-2	38	< 5	< 5	NR	NR
20-009-SW-3	40	< 5	11	NR	NR
20-009-SW-4	35	< 5	5	NR	NR

Legend

SE-1- 2 miles downstream of Combination Mill in South Fork Lower Willow Creek et USFS/privete boundary.
SE-2- Below Hg-amalgem mill in South Fork Lower Willow Creek; 6000 feet downstream from Combination Mill.
SE-3- Above Hg-amalgam mill in South Fork Lower Willow Creek, 5500 feet downstreem from Combination Mill.
SE-4- Just below Combination Mill in South Fork Lower Willow Creek.
TP2- Composite of TP2A,2B, 2C, 2D, 2E, 2F.
TP3- Composite of TP3A, 3B, 3C, 3D.
TP4- TP4B.
BACKGROUND- Taken from Combination Mill (20-009-SS1) (1993 data).
SW-1- Same as SE-1.
SW-2-Same as SE-2.
SW-3- Seme as SE-3.
SW-4- Seme as SE-4.

XRF ANALYSIS RESULTS

COMBINATION II
PA NO. 20-009

Mine Name: Combination II PA No. 20-009
XRF Field Analyses
Results in PPM

XRF SAMPLE I.D.	CrHI	K	Ca	Tl	CrLO	Mn	Fe	Co	Ni	Cu	Zn	As	Se
TP3-COMP		6644.21	2560.95	211.749 *			17725.3	463.687 *		1698.24	281.834	339.828	
TP2-COMP-SDUP		6854.02	2629.01	347.707 *			17552.4	288.018 *		1666.08	365.06	288.988 *	
TP2A		8029.89	1918.09	477.589 *			13184.4	242.072 *		839.855	274.518	205.878 *	
TP2B		2593.37	3491.39	186.495 *		838.368	23903.4			2976.58	249.615	605.078 *	
TP2C		5689.21	2935.12	504.743 *			17716.9			1164.9	258.863	221.36 *	
TP2D		6023.01	2120.63	321.835 *			14713.3	349.449 *		1803.04	327.844	264.149 *	
TP2EA		9785.84	2135.62	293.626 *			12922.3			981.87	265.296	296.307 *	
TP2EB		4045.74	2802.84	297.305 *	222.295 *		15700.9			956.683	334.68	214.298 *	
TP3A		1257.09 *	2594.95				14114.3	387.671 *		2248.99	247.392	364.551 *	
TP3B		1319.74 *	2604.02				15497.3	344.285 *		2727.27	234.963	378.88 *	
TP3C		1443.04 *	3117.12				13189.1			2059.04	172.68 *	303.785 *	
TP3D		1244.63 *	2922.26				15016.3	365.107 *		1949.54	227.807	380.96 *	
TP4A		19413.5	5699.9	2055.64		697.847 *	17271.8	560.832 *			457.077		
TP4B		4382.58	4595.83	369.688 *			25400.7			4419.96	373.714	729.514 *	55.3297 *
TP2D-DUP		9175.67	3052.93	534.841 *			17817.3	399.479 *		2141.02	354.467	386.423 *	28.9198 *
TP3C-DUP		1200.18 *	2618.66				14582.3	251.026 *		2443.97	185.169 *	248.238 *	*
TP4B-DUP		2887.25	4300.2	223.882 *		373.122 *	25316.6	579.172 *		3211.05	342.09	626.523 *	35.2076

XRF SAMPLE I.D.	Sr	Zr	Mo	Hg	Pb	Rb	Cd	Sn	Sb	Ba	Ag	U	Th
TP3-COMP	12.3817 *	78.8403	5.20186	190.121	3253.12	67.7468	180.337 *		4119.59	447.076	149.942		38.0169 *
TP2-COMP-SDUP	12.7136 *	75.5286		212.809	3342.88	53.5369			4242.54	411.63	102.173 *		35.7394 *
TP2A	9.59276 *	98.0898	8.43125 *	122.298 *	2091.07	53.4567			1878.69	313.928			19.5003 *
TP2B	18.6734 *	30.6636	13.054	253.062	5048.51	71.024		142.336 *	7238.67	506.4	272.009 *		89.0371
TP2C	16.9383 *	69.1894	9.11063 *	115.876 *	1983.64	54.8718		80.8609 *	3296.39	323.323	161.204 *		34.7937 *
TP2D	15.8296 *	103.433	5.92113 *	314.476	3162.28	52.0942 *		97.6069 *	3936.13	481.742	192.267 *		37.6017 *
TP2EA	11.5055 *	114.119		121.517 *	1899.19	64.3791			2245.73	348.883	138.964 *		29.8508 *
TP2EB	7.69479 *	38.7493	4.95148 *	139.198 *	2122.28	41.8532 *			2880.11	283.961	111.723 *		30.657 *
TP3A	9.3047 *	15.9261 *	5.52294 *	191.821 *	3888.97	32.8097 *		96.1701 *	5604.63	315.379	219.873 *		28.6347 *
TP3B		19.772 *	5.2808 *	158.222 *	4334.27	42.9848 *		166.775 *	5779.82	287.5	124.229 *		40.4345 *
TP3C		20.0012	6.73016 *	135.522 *	2914.36	36.6818 *	147.905 *	155.526 *	4699.81	246.512	138.467 *		39.8554 *
TP3D	9.11336 *	20.1369	6.54113 *	167.734 *	3479.66	40.4058 *		164.047 *	5511.12	308.334	203.963 *		35.5655 *
TP4A	92.6959	296.288	6.55342 *		29.3471 *	152.283				639.587			19.0081 *
TP4B	22.6181 *	39.8203	11.692 *	369.482	6258.48	69.1911		125.892 *	8285.65	626.358	287.966 *		60.3284 *
TP2D-DUP	16.2557 *	104.333	6.37799 *	399.996	3317.53	53.343 *			4066.78	477.719	182.831 *		40.876 *
TP3C-DUP		20.3363	5.01148 *	151.664 *	3445.16	36.6129 *	143.168 *	116.61 *	5097.03	258.676	215.163 *		33.3427 *
TP4B-DUP	18.614 *	64.5547	8.42685 *	369.495	5508.9	61.5983		115.431 *	7876.2	603.431	244.235 *		42.373 *

ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS) SCORESHEET

COMBINATION II
PA NO. 20-009

AIMSS SCORESHEET

SITE NAME: COMBINATION II
PA NUMBER: 20-009A

LINE NO.				
		GROUNDWATER PATHWAY		
1		OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT		20
3B		GW DEPTH		20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	400
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	400
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	284.611
6		WELLS - 1 MI. x 2.5		2.5
7	GW - TARGETS	WELLS - 1 TO 4 MI		0
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	2.5
10		**GROUNDWATER SCORE**	LINES 4 x 5 x 9	284611
		SURFACE WATER PATHWAY		
11		OBSERVED RELEASE		300
12	SW - LIKELIHOOD OF RELEASE	EXCEEDENCES		100
13A		CONTAINMENT		20
13B		DISTANCE TO SW		20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	400
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	800
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	315.222
16		DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		11
18		WETLANDS		10
19	SW - TARGETS	FISHERY		5
20		RECREATION		5
21		IRRIGATION/STOCK		2
22		T & E SPECIES HABITAT		5
23		TARGETS SCORE	SUM LINES 16 THRU 22	38
24		**SURFACE WATER SCORE**	LINES 14 x 15 x 23	9582749
		AIR PATHWAY		
25		OBSERVED RELEASE		0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT		10
26B		DISTANCE TO POPULATION		5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	50
27		LIKELIHOOD SCORE	LINES 25 + 26C	50
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	28.117
29		POPULATION - 4 MILES		1
30		NEAREST RESIDENCE		0
31	AIR - TARGETS	WETLANDS		10
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		5
34		TARGETS SCORE	SUM LINES 29 THRU 33	16
35		**AIR PATHWAY SCORE**	LINES 27 x 28 x 34	22494
		DIRECT CONTACT PATHWAY		
36		OBSERVED EXPOSURE		50
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY		20
37B		DISTANCE TO POPULATION		5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	100
38		LIKELIHOOD SCORE	LINES 36 + 37C	150
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	25.493
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE		1
41		NEAREST RESIDENCE		0
42		RECREATIONAL USE		10
43		TARGETS SCORE	SUM LINES 40 THRU 42	11
44		**DIRECT CONTACT SCORE**	LINES 38 x 39 x 43	42063
45	**TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE** (LINES 10 + 24 + 35 + 44) / 100,000			**99.32**

SITE NAME: COMBINATION II
PA NUMBER: 20-009A

SITE SAFETY

LINE NO.				
1	THREAT	ACCESSIBILITY		20
2		OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	0
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	0
5		HAZ. STRUCTURES	40 EA.	0
6		EXPLOSIVE HAZARD		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 THRU 7	0
9		POPULATION - 1 MILE		1
10	TARGETS	NEAREST RESIDENCE		0
11		RECREATIONAL USE		10
12		TARGETS SCORE	SUM LINES 9 THRU 11	11
13		**SITE SAFETY SCORE**	(LINES 1 x 8 x 12) / 1,000	**0.00**

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY SITE INVESTIGATION LOG SHEET

Mine/Site Name: SUNRISE/QUEEN MILLSITE **PA#:** 20-036

Date: October 16, 1995 **Time:** 1145-1500

Field Team Leader: Tuesday, Pioneer

Sampling Personnel: Flammang, Pioneer

Visitors: None

Weather/Seasonality Observations: Windy; cool; cloudy.

Photographic Log (Photo No.'s/Video Tape Number)**:** #18: Mill foundation; #19: Beaver pond upstream from tailings; #20: TP-2 from road; #21: TP-3 from road. Video Tape No. 1

General Comments/Observations (not covered specifically in attached Inventory Forms)**:** Did not investigate mine operation. Dumps are far up the hillside, well away from surface water. Mill is also known as the Henderson Mill.

Other Hazardous Materials/Substances Present: Some copper-sulfate was observed on the ground near the mill (mill reagent).

General Comments on Potential Remedial Alternatives: TP-2 and TP-3 are "wet closed" already. Ponded water flows through and into Henderson Creek. Isolate wet tailings from active stream. Cover and revegetate small amount of dry tailings.

I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): SUNRISE/QUEEN MILLSITE **PA#:** 20-036

Legal Description: T 8N ;R 14W ;Sec. 3 , NE 1/4 NE 1/4 ___ 1/4

County: Granite **Mining District:** Combination

Latitude: N 46° 29' 03" **Longitude:** W 113° 20' 05"

Primary Drainage Basin and Code: Flint Creek/17010202
Secondary Drainage Basin: Henderson Creek

USGS Quadrangle map name(s): Henderson Mountain

Mine Type/Commodities: Millsite/Gold

Activity Status: Active___, Inactive/Exploration___, Abandoned X .

Ownership status: Known Y X N___; private/public? Private
Owner, Agent, or Contact (Include address and phone when available): Copper Queen Mining Co., #3 Clover View, Helena, MT 59601 (1987 information).

Relationship to other mines/sites in the area/district: 3 miles northeast of Black Pine Mine

Regulatory Status (Activity by other agencies)? Hardrock permits? Past Reclamation Activities? Unknown

General site features: Elevation 5500', Slope 0-5°, Aspect South

Land use: Mining___, Recreational X , Residential___, Urban___, Agricultural X , Other(Specify)___

Area of disturbed/unvegetated lands? < 0.5 acre(s).
Site Dimensions: 400 feet x 150 feet

Predominant vegetation types: Willows/grasses

Access: roads - good (paved)___, poor (maintained dirt road) X , 4wd___, trail___.
Other logistical considerations (proximity to other sites). 3 miles northeast of Black Pine Mine

Well logs within 1 mile radius; **(Attach MBMG Well Log Printout(s):** There are no well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also note presence of radioactive minerals). Mine located on south face of Sunrise Mountain. Mill tailings in Henderson Creek below mine. Rocks at Sunrise Mountain are in the Newland formation, which consists of impure limestones with calcareous shales. Henderson Creek flows through and over tailings northeast to confluence with Flint Creek approximately 7 miles downstream.

Mining/milling history, ore type/tenor, host rock, gangue: Deposit is a replacement vein in limestone. Oxidized ore near the Apex is composed of quartz, calcite, limonite, and cuprite. Sulfide ore consists of quartz, calcite, pyrite, chalcopyrite, and bornite.

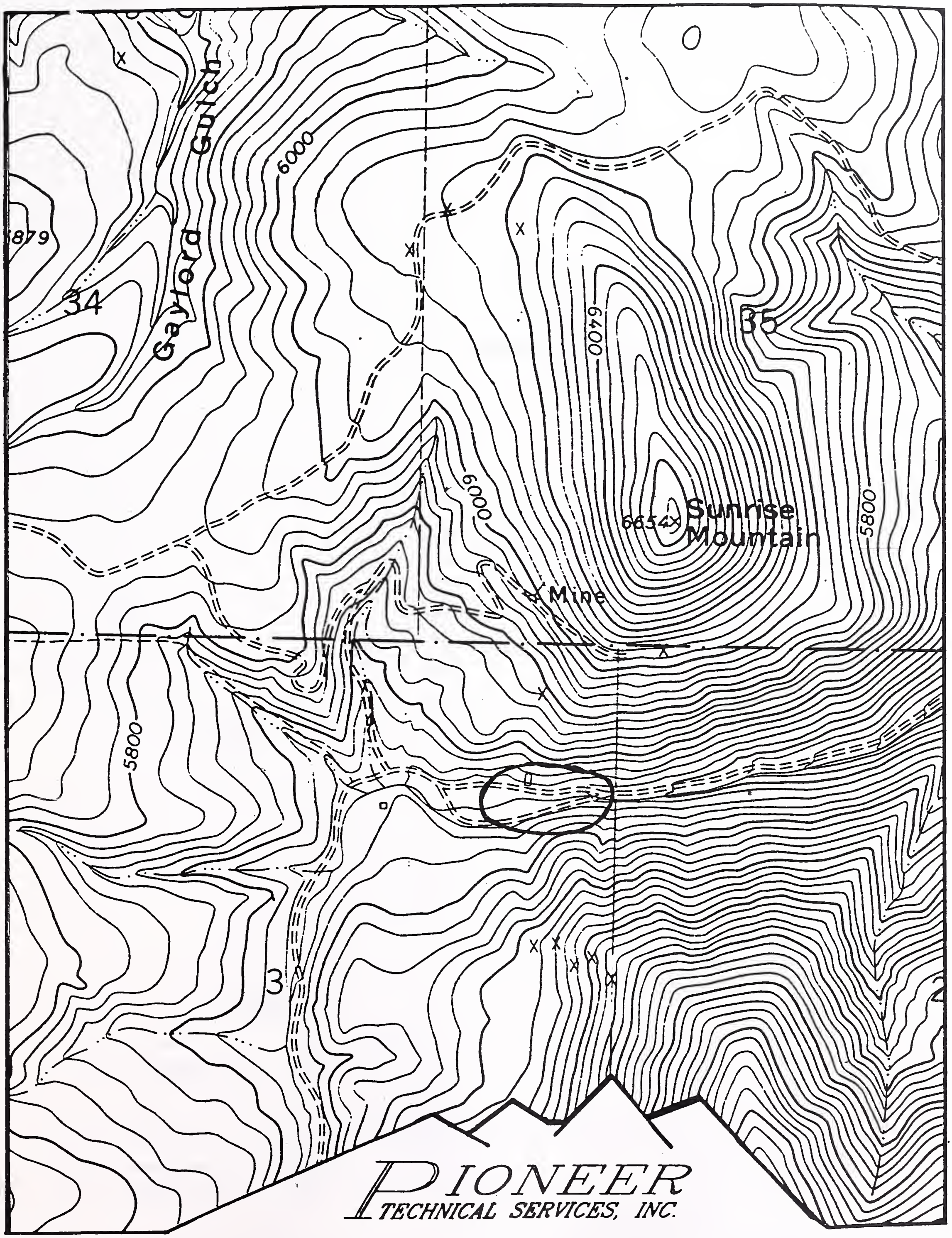
Mine Operation?
Shafts - Yes___, No_X_, # ____, Comment
Adits - Yes_X_, No___, # ____, Comment
Pits - Yes___, No_X_, # ____, Comment
Placers - Yes___, No_X_, # ____, Comment
Other - Yes___, No_X_, # ____, Comment

Mill Operation? Yes_X_, No____. If yes answer the next three questions:

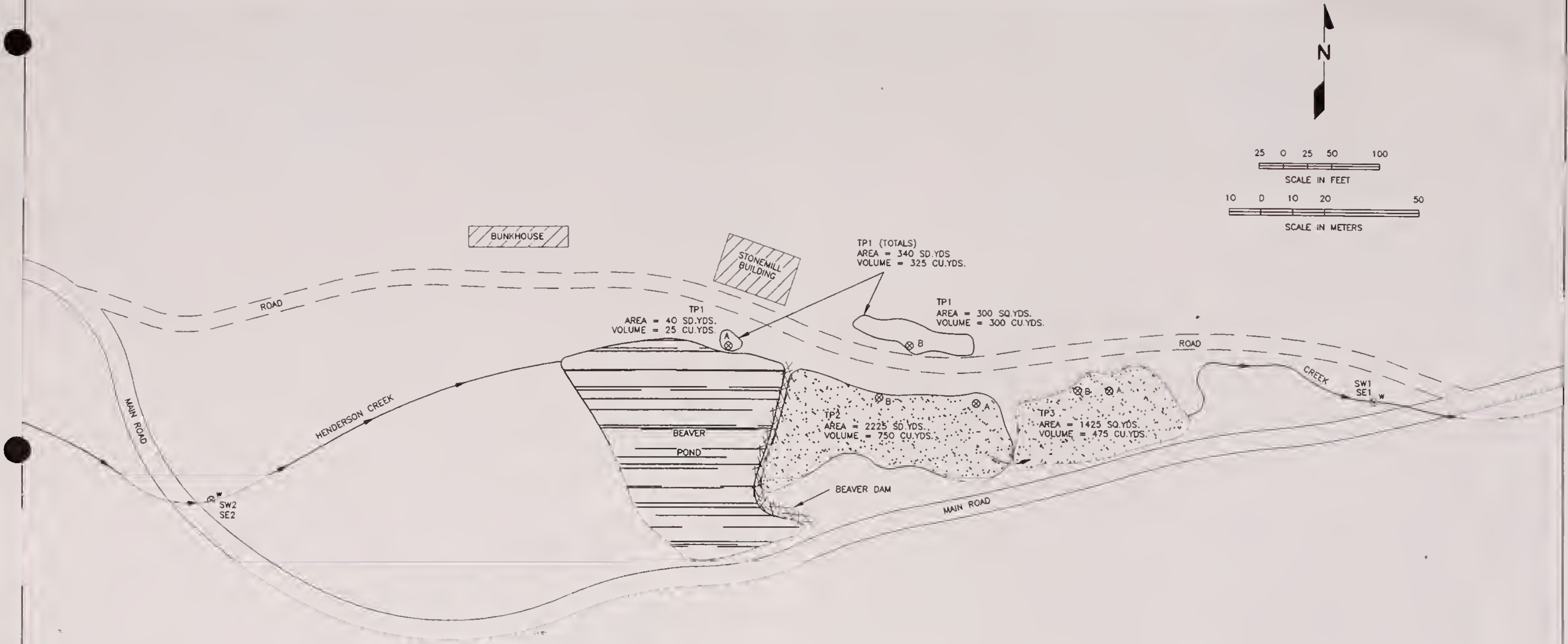
Period(s) of Operation: 1892 to 1903

Origin of Ore Milled - Custom Mill___ Dedicated Mill_X_; Number and names of mines that supplied mill feed: Mill is situated in Henderson Gulch south of the mine, once connected by a surface gravity tramway (Sunrise and Queen Mines).

Process? Hg-amalgam, CN$^-$ leach (vat, heap), floatation, smelting?
Treated by wet-crushing, amalgamation and concentration; method not too successful for low-grade ore.



SUNRISE/QUEEN MILLSITE, P.A. NO. 20-036
T08N, R14W, SECTION 3
SCALE: 1" = 1000'



LEGEND

⊗	XRF SAMPLE	▨	STRUCTURE
⊗ᵂ	WATER SAMPLE GROUND AND SURFACE		PONDED WATER
—•—	DRAINAGE		SLOPE DIRECTION
— • —	DRY DRAINAGE		WASTE ROCK DUMP OR TAILINGS PILE
═	IMPROVED ROAD		BEAVER DAM
= = =	UNIMPROVED ROAD		

GPS FILE CREATED 10/16/95

DRAWN FOR:
PIONEER
TECHNICAL SERVICES, INC.
P.O. BOX 3445
BUTTE, MT 59702

TITLE:
SUNRISE/QUEEN
PA# 20-036

DRAWING NO.: PT342115
DATE: 1/24/96
PLOT SCALE: 1 = 30

II. INFORMATION COLLECTED ON SITE

A. SOLID MATRIX WASTE CHARACTERIZATION

1. **Waste Characteristics** - *Use table on following page.*

Unique source identification: (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TP); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures/vessels sound, are runon/runoff controls in place, are wastes covered or vegetated, pond liners intact?

2. **TAILINGS IMPOUNDMENTS** - *If tailings impoundments are also present, complete the following questions.*

Describe the tailings grain size distribution (approximate % sand, silt, & clay): Very fine silt and clay in ponds; sandy fractions on banks.

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): Unknown; covered with water

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): TP-2 and TP-3 are wet (95% covered with water).

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): Poor; most of the tailings appear to have washed away.

Comments on potential for mitigation: Some wetlands vegetation is becoming established along shores. Wet closure needs to route stream around tailings instead of over them.

SOURCE INVENTORY FORM

SAMPLERS: Tuesday

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd³)	LOCATION/DESCRIPTION	CONTAIN-MENT	pH SU (D/S)*	RADIO-ACTIVITY (mR/HR)	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
TP-1A	TAIL	325	Small pile of tailings above and west of mill	None	3.5	0.04	20-036-TP-1	12/17/95 1200	T-Metals, ABA
TP-1B	TAIL		Small pile of tailings east of mill	None	6.8	0.03			
TP-2A	TAIL	750	Middle pond, bank tailings	None	5.1	0.05	20-036-TP-2	12/17/95 1200	T-Metals, ABA
TP-2B	TAIL		Middle pond, pond tailings	None	5.6	0.045			
TP-3A	TAIL	475	East pond, pond tailings (east)	None	5.6	0.04			
TP-3B	TAIL		East pond, pond tailings (west)	None	4.6	0.04			

* pH readings were taken directly on-site (Kelwey Meter).

Comments or deviations from SOPs: 20-036-TP-1 is a composite of TP-1A and -1B. 20-036-TP-2 is a composite of TP-2A, -2B, -3A, and -3B. Background sample was collected at the Combination Millsite (20-009-SS-1) during the 1993 investigation.

B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes___, No_X_, Number:____ Identification:____________

Filled shafts: Yes___, No_X_, Number:____ Identification:____________

Seeps/Springs: Yes___, No_X_, Number:____ Identification:____________

Groundwater wells within 4 miles?: Yes___, No_X_;
Number of well logs:_______

Distance to nearest well used for drinking:
___<1,000 ft;___1,000 ft to 0.5 miles;_X_>0.5 miles.

Sample types: Flowing adits (AD); filled shafts (SH); Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?
Definite____, Probable_X_, Possible____, Unlikely____.
Wastes are in surface water, probably leaching to alluvial groundwater

Approximate Depth to Groundwater:_X_<25 ft;___ 25 - 100 ft;___ >100 ft.

Other observations/notes: N/A

GROUNDWATER INVENTORY FORM

SAMPLERS: ____________________

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SOURCE	FLOW* cfs/gpm	pH SU	SC μS/cm @ 25°C	Eh mV	Temp °C	ALK. mg/L as $CaCO_3$	Depth ft	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
No samples were taken.												

*FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): ____________________

C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/run-off) and directions on sketch maps.

Flowing streams: **Yes**_X__, **No**___, **Name(s):** Henderson Creek

Dry streambeds: **Yes**____, **No**_X_, **Name(s):**

Other surface water: **Yes**_X__, **No**___, **Name(s)/Description:** Ponds in Henderson Creek

Waste materials within any floodplain: **Yes**_X__, **No**___ **Source ID(s):**

Approximate Flood frequency?_X_**1 yr,**___**10 yr,**___**100 yr**

Estimated seasonal flow of stream(s) (cfs/gpm)? 0.09 cfs
High Flow: 0.3 cfs , **Average Flow:** 0.1 cfs

Distance between waste source(s) and nearest surface water body (ft)?
0 feet; in surface water.

Surface water draining onto or through waste sources: **Yes**_X__, **No**____,
Describe: Henderson Creek flows through TP-2 and TP-3.

Surface water use within 15 miles downstream? **(Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)**
Wetlands, fishery, agriculture

Observed erosional/sedimentation/stream turbidity problems? Yes_X__,
No_____. **Distance downstream (ft)? 0-500**_X_**; 500-1,000**___**; >1,000**___.
Describe/explain **(Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present):** Iron-staining on rocks downstream.

SURFACE WATER INVENTORY FORM

SAMPLERS: Tuesday

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SAMPLE LOCATION	pH SU	SC $\mu S/cm$ @ 25°C	Temp °C	ALK. mg/L as $CaCO_3$	Flow* cfs/gpm	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
SW-1	SW	Downstream (west) of site in Henderson Creek	7.94	272	6.6	75	0.09 cfs (E)	20-036-SW-1	10/16/95 1300	T-Metals, TDS, Hardness, Cl, SO4
SE-1	SE	Downstream (west) of site in Henderson Creek	N/A	N/A	N/A	N/A	N/A	20-036-SE-1	10/16/95 1300	T-Metals
SW-2	SW	Upstream of site in Henderson Creek	8.40	260	7.5	85	0.09 cfs (E)	20-036-SW-2	10/16/95 1400	T-Metals, TDS, Hardness, Cl, SO4
SE-2	SE	Upstream of site in Henderson Creek	N/A	N/A	N/A	N/A	N/A	20-036-SE-2	10/16/95 1400	T-Metals

FLOW: Estimated (E) or Measured (M)?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): ______________________

D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

AMD Characteristics:

Presence and abundance of sulfides? (*SO_3*)

Presence of evaporative salt deposits? (*ESD*)

Discolored or turbid seepage? (*SPG*)

Presence of long filamentous algae in drainages, mosses in moist areas?

Presence of ferric hydroxide precipitates? (*FEOX*)

Presence of burned or stressed vegetation? (*VEG*)

pH ≤ 5.0 (*pH*)

General Potential for AMD Mitigation:

Area available for treatment (acres)? 3 acres, includes existing ponds

Wetlands present: Yes X **, No** ___ **, Describe:** Large wetland upstream of site in Henderson Creek

Carbonate rocks/soils: Yes X **, No** ___ **, Describe:** Newland formation, calcareous rocks

E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10 X **; 10-30** ___ **; 30-100** ___ **; 100-300** ___ **; 300-1,000** ___ **; 1,000-3,000** ___ **; 3,000-10,000** ___ **; 10,000 or greater** ___ **; Comments** ___

Nearest residence: ___ **<1,000 ft;** ___ **1,000 ft - 0.5 miles;** X **>0.5 miles.**

For each source (table next page):

Available fine materials? Surface area?

Uncovered and unvegetated? Wet or dry?

Overall dust propagation potential:
observed high moderate low none

ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

SAMPLERS: Tuesday

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LIST)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/HIGH/MODERATE/LOW/NONE)
TP-1	FEOX	Dry	3,060	3,060	Yes	Low
TP-2	FEOX	Wet (95%)	20,025	1,000	Yes	Low
TP-3	FEOX	Wet (95%)	12,825	640	Yes	Low

Notes and Clarifications: ____________________

F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes_____, No_X_.
Describe:________________________________

Population within 1 mile: 1-10_X_; 10-30___; 30-100___; 100-300___; 300-1,000____; 1,000-3,000____; 3,000-10,000____; 10,000 or greater____;
Comments________________________________

Evidence of recreational use on site: Yes_X_, No____, Describe:_Camp remains_

Accessibility (check each that apply):_X_Easily accessible - no fences, gates, or warning signs;___Moderately Accessible - barbed wire fences, road gated, or signs posted;____Difficult Access - chain-link fence, road gated and locked, site guarded (does not include locked or manned access points located more than 0.5 miles from the actual site).

Sensitive environments on-site or adjacent to site:
State or National Parks - Yes____, No_X_, Comment________________
Wilderness Area - Yes____, No_X_, Comment________________
T&E Species Habitat - Yes____, No_X_, Comment________________
Bat Habitat - Yes____, No_X_, Comment________________

Primary Drainage_X_; Secondary Drainage___; No Information___:
Riparian Habitat Quality - High____, Medium_X_, Low___
Wetlands Frontage - High____, Medium_X_, Low___
Fisheries Habitat and Species Classification - _4_
Sport Fishery Classification - _3_

G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes____, No_X_, Number_____, types and locations:____

Hazardous structures: Yes_X_, No____, Number_1__, types and locations:_Bunk house west of mill is collapsing._

Unstable highwalls, pits, trenches, slopes: Yes____, No_X_, Number_____, types and locations:__________________________

Unstable waste piles, impoundments, undercut banks: Yes_X_, No_____, Number_1__, types and locations:_Remains of TP-2 banks are eroding to creek._

Fire and/or Explosion hazards: Yes____, No_X_, Explain:__________________

Bibliography

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MDEQ/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for Sunrise/Queen, Prepared by Northern Engineering and Testing, July 13, 1987.

USGS, Geology and Ore Deposits of the Philipsburg Quadrangle, Montana, Professional Paper 78, Written by William Harvey Emmons and Frank Cathcart Calkins, 1913.

USGS, Topographic Map, Henderson Mountain, Montana, 7 1/2 minute Quadrangle, 1971.

LABORATORY ANALYTICAL DATA

SUNRISE/QUEEN
PA NO. 20-036

Sunrise/ Queen Millsite PA# 20-036
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 10/16/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
20-036-SE-1	6.8 UJX	381 J	193	1.2	3100	4.8 J	6.0 J	77.8 J	28500	9.3 UJ	3550	1710	0.19 J	3.1 UJX	1.0 U	21.7	NR
20-036-SE-2	5.5 UJX	15.2 J	91.5	0.59 U	2160	4.6 J	3.3 J	14.4 J	7280	9.1 J	1090	326	0.067 J	3.0 JX	0.78 U	23.4	NR
20-036-TP1	10.6 JX	1230 J	40.2	2.6	480	1.3 UJ	1.5 UJ	374 J	50300	38.8 J	115	15.4	5.9 J	1.9 UJX	16.5	10.4	0.374
20-036-TP2	6.4 UJX	866 J	69.4	2.8	1060	2.4 J	2.2 UJ	450 J	42400	28.1 J	777	77.7	4.3 J	3.8 JX	9.9	15.9	0.653
BACKGROUND	33.3	76.3	329	2	NR	6.06	6.18	116	11700	85.8	NR	1530 J	1.33 J	6.77	NR	47.4	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
20-036-TP-1	0.29	9.06	-0.94	-10	0.28	0.01	<0.01	0.31	-1.25	-1.25	-2.63	6.88	-9.77	-20.52
20-036-TP-2	0.33	10.3	3.04	-7.27	0.32	<0.01	0.01	0	3.04	3.04	6.38	7.81	-5.97	-12.53

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
20-036-SW-1	4.6	87.9	106	0.046 U	36400	8.7 U	8.3 U	7.3 J	1540 J	0.93	7270	119 J	0.14 UJX	16.9 U	0.37 JX	9.1 U	121
20-036-SW-2	4.6	16.6	113	0.046 U	33900	8.7 U	8.3 U	3.4 J	286 J	0.95	6570	167 J	0.20 JX	16.9 U	0.46 JX	9.1 U	112

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids		CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
20-036-SW-1	208		7	22.0	NR	NR
20-036-SW-2	174	<	5	16	NR	NR

Legend

SE-1- Downstream of site in Henderson Creek.
SE-2- Upstream of site in Henderson Creek.
TP1- Composite of TP1A, 1B.
TP2- Composite of TP2A, 2B, 3A, 3B.
BACKGROUND- Taken from the Combination Mill (20-009-SS1) (1993 data).
SW-1- Same as SE-1.
SW-2- Same as SE-2.

XRF ANALYSIS RESULTS

SUNRISE/QUEEN
PA NO. 20-036

Mine Name: Sunrise/Queen Mill PA No. 20-036
XRF Field Analyses
Results in PPM

XRF SAMPLE I.D.	CrHI	K	Ca	Tl	CrLO	Mn	Fe	Co	Ni	Cu	Zn	As	Se
20-036-TP1A	203.94	5418.9	1617.8	190.73			41210	606.51 *		239.42 *		838.94 *	
20-036-TP1B	250.15	6455	1564.1	543.97 *			47840	685.75		257.58 *		1037.4 *	
20-036-TP2A	116.78	10667	2499.8	879.35 *		469 *	49704	856.97		326.26 *		919.19 *	
20-036-TP2B		5673.7	2074.8	512.51	339.61 *		51770	613.69		335 *		1121 *	
20-036-TP1A-SDUP	281.1	5518	1324.6	153.6 *			46621	703.7 *		325.77 *		1080.4 *	
20-036-TP3A	240.71	10747	8676.2	1236.8			43912	681.73 *		455.99 *		615.98	
20-036-TP3B	442.4	19129	6630	1806.5		581.83 *	92560	1331.2		1270.1 *		1792.8 *	
20-036-TP3B-DUP	295.5	19459	6753.6	1854.5		673.86 *	93662	1270.9		1285.7 *		1817.9 *	
20-036-TP1-COMP		5993.5	1786.7	553.25			47455	581.5 *		356.95 *		1054.6	

XRF SAMPLE I.D.	Sr	Zr	Mo	Hg	Pb	Rb	Cd	Sn	Sb	Ba	Ag	U	Th
20-036-TP1A	18.912 *	22.247 *	81.025	72.233	123.78	91.356				77.526 *			94.185
20-036-TP1B	19.93 *	42.071 *	85.481	33.291	120.17	88.832			133.18 *	97.528			83.85 *
20-036-TP2A	29.327 *	47.779 *	78.176 *	41.775	89.137	74.359			69.947 *	148.87	107.15		52.773 *
20-036-TP2B	29.854 *	18.232 *	93.005		169.86	101.46			65.158	133.6			116.37 *
20-036-TP1A-SDUP	14.7 *	27.607 *	91.247 *	51.823	158.79	98.973			69.868 *	75.592 *			111.52
20-036-TP3A	76.175 *	78.432 *	51.169 *		91.426	88.225				417.9			51.33 *
20-036-TP3B	45.77 *	53.149 *	110.74		160.44	177.44			80.365 *	318.78			90.404 *
20-036-TP3B-DUP	53.785 *	60.953 *	111.29	68.333	159.16	194.83	214.93 *			337.14			89.696 *
20-036-TP1-COMP	16.899 *	25.834 *	88.965	61.888	138.56	109.9			64.632 *	86.702 *	121.64		107.05 *

ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS) SCORESHEET

SUNRISE/QUEEN
PA NO. 20-036

AIMSS SCORESHEET

SITE NAME: SUNRISE/QUEEN MILL
PA NUMBER: 20-036

LINE NO.				
		GROUNDWATER PATHWAY		
1	GW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A		CONTAINMENT		20
3B		GW DEPTH		20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	400
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	400
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	1.142
6	GW - TARGETS	WELLS - 1 MI. x 2.5		0.0
7		WELLS - 1 TO 4 MI		0
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	0.0
10		**GROUNDWATER SCORE**	LINES 4 x 5 x 9	0
		SURFACE WATER PATHWAY		
11	SW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		300
12		EXCEEDENCES		100
13A		CONTAINMENT		20
13B		DISTANCE TO SW		20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	400
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	800
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	1.194
16	SW - TARGETS	DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		1
18		WETLANDS		10
19		FISHERY		5
20		RECREATION		5
21		IRRIGATION/STOCK		2
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 THRU 22	23
24		**SURFACE WATER SCORE**	LINES 14 x 15 x 23	21970
		AIR PATHWAY		
25	AIR - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
26A		CONTAINMENT		10
26B		DISTANCE TO POPULATION		5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	50
27		LIKELIHOOD SCORE	LINES 25 + 26C	50
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.020
29	AIR - TARGETS	POPULATION - 4 MILES		1
30		NEAREST RESIDENCE		0
31		WETLANDS		10
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 THRU 33	11
35		**AIR PATHWAY SCORE**	LINES 27 x 28 x 34	11
		DIRECT CONTACT PATHWAY		
36	LIKELIHOOD OF EXPOSURE	OBSERVED EXPOSURE		50
37A		ACCESSIBILITY		20
37B		DISTANCE TO POPULATION		5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	100
38		LIKELIHOOD SCORE	LINES 36 + 37C	150
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.020
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE		1
41		NEAREST RESIDENCE		0
42		RECREATIONAL USE		10
43		TARGETS SCORE	SUM LINES 40 THRU 42	11
44		**DIRECT CONTACT SCORE**	LINES 38 x 39 x 43	33
45	**TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE** (LINES 10 + 24 + 35 + 44) / 100,000			**0.22**

SITE NAME: SUNRISE/QUEEN MILL
PA NUMBER: 20-036

LINE NO.		SITE SAFETY		
1	THREAT	ACCESSIBILITY		20
2		OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	0
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	0
5		HAZ. STRUCTURES	40 EA.	40
6		EXPLOSIVE HAZARD		100
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 THRU 7	140
9		POPULATION - 1 MILE		1
10	TARGETS	NEAREST RESIDENCE		0
11		RECREATIONAL USE		10
12		TARGETS SCORE	SUM LINES 9 THRU 11	11
13		**SITE SAFETY SCORE**	(LINES 1 x 8 x 12) / 1,000	**30.80**

20-0[illegible] foundation

20-036, #19: Possible beaver pond upstream from tailings

20-036, #20: TP-2 from road

20-036, #21: TP-3 from road

PHILIPSBURG

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY
SITE INVESTIGATION LOG SHEET

Mine/Site Name: DOUGLAS CREEK WASTE ROCK **PA#:** 20-503

Date: October 19, 1995 **Time:** 1600-1815

Field Team Leader: Tuesday, Pioneer

Sampling Personnel: Bisch, Flammang, Pioneer

Visitors: None

Weather/Seasonality Observations: Cold; some snow on ground.

Photographic Log (Photo No.'s/Video Tape Number)**:** No photos were taken.
Video Tape No. 1

General Comments/Observations (not covered specifically in attached Inventory Forms)**:**
Large waste rock dump adjacent to Douglas Creek. Large volume of adit discharge; appears to be diverted to Antoniolli Mill in Philipsburg.

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Move waste rock dump out of Douglas Creek floodplain. Grade, amend, and revegetate waste rock. May have to treat adit discharge water.

I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): DOUGLAS CREEK WASTE ROCK **PA#:** 20-503

Legal Description: T 07N ;R 13W ;Sec. 31 , SE 1/4 SW 1/4 ____ 1/4

County: Granite **Mining District:** Philipsburg

Latitude: N 46° 18' 50" **Longitude:** W 113° 16' 15"

Primary Drainage Basin and Code: Flint Creek/17010202
Secondary Drainage Basin: Douglas Creek

USGS Quadrangle map name(s): Philipsburg

Mine Type/Commodities: Hardrock/Gold, Silver

Activity Status: Active ___, Inactive/Exploration X , Abandoned ___.

Ownership status: Known Y X N ___; private/public? Private
Owner, Agent, or Contact (Include address and phone when available): Peter Antonioli

Relationship to other mines/sites in the area/district: Below Douglas Creek Tailings 1/4 mile; near all in Philipsburg District.

Regulatory Status (Activity by other agencies)? Hardrock permits? Past Reclamation Activities? May be part of Contact Mining Co. (Bill Antoniolli) operating permit.

General site features: Elevation 5750' , Slope 20° ,
Aspect West

Land use: Mining X , Recreational X , Residential ___, Urban ___,
Agricultural ___, Other(Specify) ___

Area of disturbed/unvegetated lands? 3 acre(s).
Site Dimensions: 1,100 feet x 400 feet

Predominant vegetation types: Pine/fir, grasses

Access: roads - good (paved) ___, poor (maintained dirt road) ___,
4wd X , trail ___.

Other logistical considerations (proximity to other sites). Below Douglas Creek Tailings

Well logs within 1 mile radius; (Attach MBMG Well Log Printout(s): There are 5 well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also note presence of radioactive minerals). Site is underlain by the Philipsburg batholith; granitic host rock. Douglas Creek flows northwest through the site; the creek disappears approximately 1 mile above Philipsburg, probably flows to Flint Creek.

Mining/milling history, ore type/tenor, host rock, gangue: Unknown; alleged to be a drain tunnel for Granite Mine.

Mine Operation?

Shafts -	**Yes**___	**No** X	**#** ___	**Comment**
Adits -	**Yes** X	**No**___	**#** 1	**Comment** Open; large discharge volume
Pits -	**Yes**___	**No** X	**#** ___	**Comment**
Placers -	**Yes**___	**No** X	**#** ___	**Comment**
Other -	**Yes**___	**No** X	**#** ___	**Comment**

Mill Operation? Yes___, No X. If yes answer the next three questions:

Period(s) of Operation: N/A

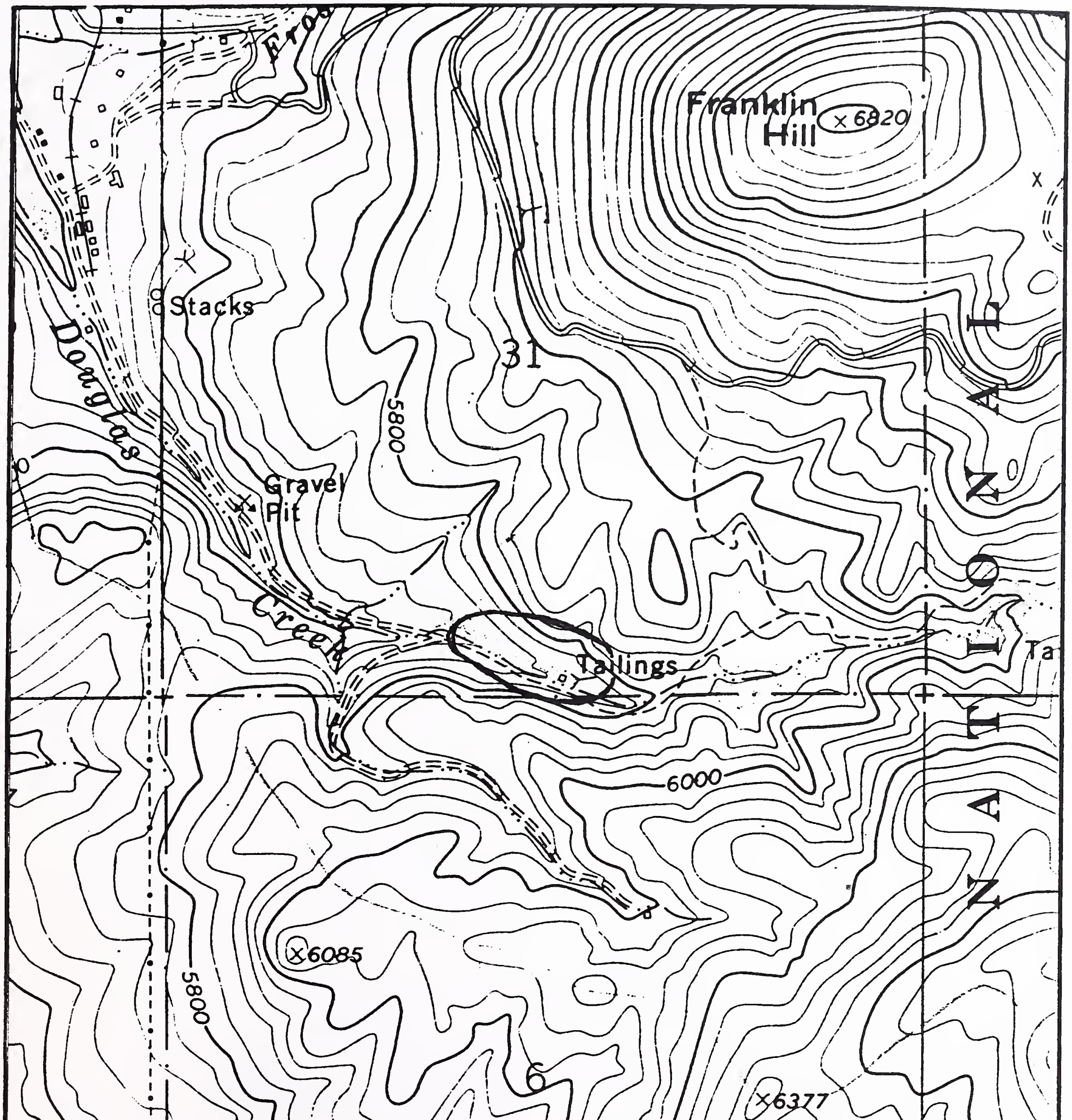
Origin of Ore Milled - Custom Mill___ Dedicated Mill___; Number and names of mines that supplied mill feed: N/A

Process? Hg-amalgam, CN^- leach (vat, heap), floatation, smelting?
N/A

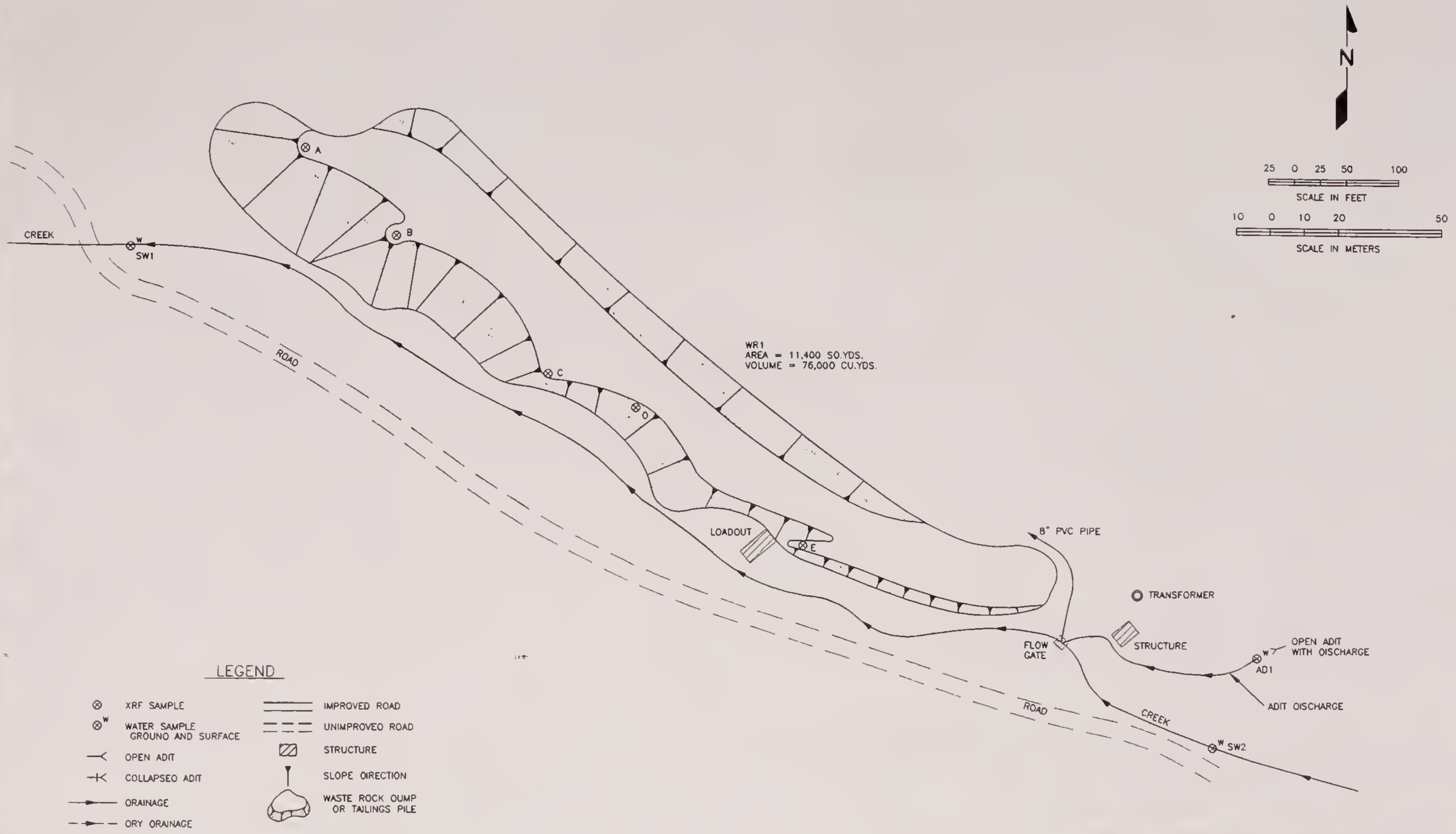
Montana Bureau of Mines and Geology
Water Well Log Data

04/08/1996

Location	Depth	Yield	Static Water Level
07N 14W 36 BA	90.0	0.0	38.00
07N 14W 36 BADD	125.0	0.0	0.00
07N 14W 36 CAB	45.0	50.0	20.00
07N 14W 36 CACC	68.0	20.0	48.00
07N 14W 36 CC	48.0	4.0	11.00



DOUGLAS CREEK WASTE ROCK,
P.A. NO. 20-503
T07N, R13W, SECTION 31
SCALE: 1" = 1000'



GPS FILE CREATED 10/19/95

DRAWN FOR:

PIONEER
TECHNICAL SERVICES, INC.
P.O. BOX 3445
BUTTE, MT 59702

TITLE:
DOUGLAS CREEK WR
20-503

DRAWING NO.: PT342111
DATE: 3/5/96
PLOT SCALE: 1 = 30

II. INFORMATION COLLECTED ON SITE

A. SOLID MATRIX WASTE CHARACTERIZATION

1. **Waste Characteristics** - *Use table on following page.*

Unique source identification: (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TP); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures/vessels sound, are runon/runoff controls in place, are wastes covered or vegetated, pond liners intact?

2. **TAILINGS IMPOUNDMENTS** - *If tailings impoundments are also present, complete the following questions.*

Describe the tailings grain size distribution (approximate % sand, silt, & clay): N/A

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): N/A

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): N/A

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): N/A

Comments on potential for mitigation: N/A

SOURCE INVENTORY FORM

SAMPLERS: Tuesday

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd³)	LOCATION/DESCRIPTION	CONTAIN-MENT	pH SU (D/S)*	RADIO-ACTIVITY (mR/HR)	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
WR-1A	WR	76,000	Large dump, south side, west end	None	6.4	0.04	20-503-WR-1	10/24/95 1200	T-Metals, ABA
WR-1B	WR		Large dump, 100 feet from west end	None	5.9	0.06			
WR-1C	WR		Large dump, center lobe	None	6.0	0.04			
WR-1D	WR		Large dump, east center	None	5.2	0.04			
WR-1E	WR		Large dump, eastern lobe	None	4.6	0.03			

* pH readings were taken directly on-site (Kelwey Meter).

Comments or deviations from SOPs: 20-503-WR-1 is a composite of WR-1A through -1D. Background sample was collected at the Granite Mountain Mine (20-110-SS-1) during the 1993 investigation.

B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes X **, No**___**, Number:** 1 **Identification:** AD-1

Filled shafts: Yes___**, No** X **, Number:**____ **Identification:**__________

Seeps/Springs: Yes___**, No** X **, Number:**____ **Identification:**__________

Groundwater wells within 4 miles?: Yes X **, No**___**;**
Number of well logs: 46

Distance to nearest well used for drinking:
___**<1,000 ft;**___**1,000 ft to 0.5 miles;** X **>0.5 miles.**

Sample types: Flowing adits (AD); filled shafts (SH); Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?
Definite____**, Probable**____**, Possible** X **, Unlikely**____**.**
Large source; shallow groundwater.

Approximate Depth to Groundwater: X **<25 ft;**___ **25 - 100 ft;**___ **>100 ft.**

Other observations/notes: N/A

GROUNDWATER INVENTORY FORM

SAMPLERS: Bisch

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SOURCE	FLOW* cfs/gpm	pH SU	SC µS/cm @ 25°C	Eh mV	Temp °C	ALK. mg/L as $CaCO_3$	D.O. mg/L	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
AD-1	AD	Adit discharge above WR-1	50 gpm (E)	6.5	934	NM	9.8	41	4.24	20-503-AD-1	10/19/95 1740	T-Metals, TDS, Hardness, SO4, Cl-

FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?

Comments or Deviations from the SOPs *(Pioneer SAP, 1993):

C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/run-off) and directions on sketch maps.

Flowing streams: Yes X , No___, Name(s): Douglas Creek

Dry streambeds: Yes____, No X , Name(s):

Other surface water: Yes X , No____, Name(s)/Description: Adit discharge

Waste materials within any floodplain: Yes X , No___ Source ID(s): WR-1

Approximate Flood frequency? X 1 yr, ___10 yr, ___100 yr

Estimated seasonal flow of stream(s) (cfs/gpm)? 0.3 cfs
High Flow: 1.0 cfs , **Average Flow:** 0.2 cfs

Distance between waste source(s) and nearest surface water body (ft)? 10 feet

Surface water draining onto or through waste sources: Yes____, No X ,
Describe: Adit discharge diverted.

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?) Douglas Creek is diverted by tube downstream. No fishery, but some wetlands.

Observed erosional/sedimentation/stream turbidity problems? Yes X , No_____. **Distance downstream (ft)?** 0-500___; 500-1,000___; >1,000 X . **Describe/explain** (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present): Iron-oxides in stream 1,500 feet below dumps. Note concrete mixing/diversion structure that combines creek and adit discharge flows.

SURFACE WATER INVENTORY FORM

SAMPLERS: Bisch

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SAMPLE LOCATION	pH SU	SC $\mu S/cm$ @ 25°C	Temp °C	ALK. mg/L as $CaCO_3$	Flow* cfs/gpm	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
SW-1	SW	Downstream of site in Douglas Creek	7.11	487	5.9	28	0.3 cfs (E)	20-503-SW-1	10/19/95	T-Metals, TDS, Hardness, SO4, Cl-
SE-1	SE	Downstream of site in Douglas Creek	N/A	N/A	N/A	N/A	N/A	20-503-SE-1	10/19/95	T-Metals
SW-2	SW	Upstream of site in Douglas Creek	7.39	145	3.2	34	0.3 cfs (E)	20-503-SW-2	10/19/95	T-Metals, TDS, Hardness, SO4, Cl-
SE-2	SE	Upstream of site in Douglas Creek	N/A	N/A	N/A	N/A	N/A	20-503-SE-2	10/19/95	T-Metals

*FLOW: Estimated (E) or Measured (M)?

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

AMD Characteristics:

Presence and abundance of sulfides?	*(SO_3)*
Presence of evaporative salt deposits?	*(ESD)*
Discolored or turbid seepage?	*(SPG)*
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	*(FEOX)*
Presence of burned or stressed vegetation?	*(VEG)*
pH ≤ 5.0	*(pH)*

General Potential for AMD Mitigation:

Area available for treatment (acres)? Less than one acre, narrow canyon

Wetlands present: Yes ___, No X, Describe: ___

Carbonate rocks/soils: Yes ___, No X, Describe: ___

E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10 ___; 10-30 ___; 30-100 X; 100-300 ___; 300-1,000 ___; 1,000-3,000 ___; 3,000-10,000 ___; 10,000 or greater ___; Comments Philipsburg

Nearest residence: ___ <1,000 ft; ___ 1,000 ft - 0.5 miles; X >0.5 miles.

For each source (table next page):

Available fine materials? *Surface area?*

Uncovered and unvegetated? *Wet or dry?*

Overall dust propagation potential:
observed high moderate low none

ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

SAMPLERS: Tuesday, Bisch

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LIST)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/HIGH/MODERATE/LOW/NONE)
WR-1	pH; FEOX	Dry	102,600	92,340	Yes	Low
AD-1	FEOX	N/A	N/A	N/A	N/A	N/A

Notes and Clarifications:

F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes_____, No_X_
Describe:____

Population within 1 mile: 1-10_X_; 10-30___; 30-100___; 100-300___; 300-1,000___; 1,000-3,000___; 3,000-10,000___; 10,000 or greater___;
Comments____

Evidence of recreational use on site: Yes_X_, No___, Describe:__Camp remains; gun shells; litter

Accessibility (check each that apply):_X_Easily accessible - no fences, gates, or warning signs;___Moderately Accessible - barbed wire fences, road gated, or signs posted;___Difficult Access - chain-link fence, road gated and locked, site guarded (does not include locked or manned access points located more than 0.5 miles from the actual site).

Sensitive environments on-site or adjacent to site:
State or National Parks - Yes___, No_X_, Comment____________
Wilderness Area - Yes___, No_X_, Comment____________
T&E Species Habitat - Yes___, No_X_, Comment____________
Bat Habitat - Yes_X_, No___, Comment_Possible (open adit)

Primary Drainage___; Secondary Drainage_X_; No Information___:
Riparian Habitat Quality - High___, Medium_X_, Low___
Wetlands Frontage - High___, Medium_X_, Low___
Fisheries Habitat and Species Classification - _4_
Sport Fishery Classification - _4_

G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes_X_, No___, Number_1_, types and locations:___ Open adit

Hazardous structures: Yes_X_, No___, Number_2_, types and locations:_ Collapsing cabin and loadout

Unstable highwalls, pits, trenches, slopes: Yes_X_, No___, Number_1_, types and locations:_ Highwall above adit

Unstable waste piles, impoundments, undercut banks: Yes_____, No_X_, Number_____, types and locations:____________________

Fire and/or Explosion hazards: Yes___, No_X_, Explain:____________________
____

Bibliography

MBMG, Well Log Database, July 14, 1994.

MDFWP, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.

MDHES/SHWB, Superfund Basics, Overview and Accomplishments of Superfund in Montana 1983-1993, November 1993.

USGS, Geology and Ore Deposits of the Philipsburg Quadrangle, Montana, Professional Paper 78, Written by William Harvey Emmons and Frank Cathcart Calkins, 1913.

USGS, Topographic Map, Philipsburg, Montana, 7 1/2 minute Quadrangle, 1971.

LABORATORY ANALYTICAL DATA

DOUGLAS CREEK WASTE ROCK
PA NO. 20-503

Douglas Creek Waste Rock PA# 20-503
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 10/19/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
20-503-SE-1	45.3 JX	1770 JX	169 J	3.5 J	1130	2.1 UJ	4.0	62.8 JX	13300 JX	331 JX	1140	5610 JX	2.3	3.1 U	48.1 JX	661 J	NR
20-503-SE-2	28.1 JX	1910 JX	160 J	3.3 J	1260	2.1 J	4.9	65.4 JX	11200 JX	313 JX	1690	5800 JX	4.1	2.9 U	71.5 JX	672 J	NR
20-503-WR-1	5.9 JX	1450 JX	152 J	1.2 J	1700	1.8 UJ	2.9	18.4 JX	16900 JX	116 JX	1150	258 JX	2.5	2.7 U	27.2 JX	57.8 J	NR
BACKGROUND	4 UJ	25 J	286	0.5 U	NR	4.6	9.8	9	13900	9	NR	1230	0.161 JX	11	NR	41	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
20-503-WR-1	0.37	11.6	2.16	-9.4	0.3	<0.01	0.07	0	2.16	2.16	4.54	9.22	-8.82	-18.53
20-503-WR-1 (dup)	0.37	11.6	1.96	-9.6	0.29	0.02	0.06	0.62	1.34	1.34	2.81	9.30	-9.17	-19.26

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
20-503-SW-1	6.9	101	19.0	1.6	61000	8.7 U	8.3 U	5.8 J	886 J	1.5	11700	9180 J	0.14 UJX	16.9 U	1.9 JX	1550	200
20-503-SW-2	8.1	128	22.7	0.25	15500	8.7 U	8.3 U	4.7 J	294 J	1.4	3320	1700 J	0.17 JX	16.9 U	0.21 UJX	417	52.3
20-503-AD-1	4.6	188	12.4	3.5	131000	8.7 U	9.1	12.1 J	3830 J	1.5	24200	21700 J	0.22 JX	16.9 U	4.2 JX	3330	426

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
20-503-SW-1	326	< 5	190	NR	NR
20-503-SW-2	102	< 5	43.0	NR	NR
20-503-AD-1	691	< 5	451	NR	NR

Legend

SE-1- Downstream of site in Douglas Creek.
SE-2- Upstream of site in Douglas Creek.
WR-1- Composite of WR1A, 1B, 1C, 1D.
BACKGROUND- Taken from Granite Mtn Mine (20-110-SS1) (1993 data).
AD-1- Adit discharge above WR1.
SW-1- Same as SE-1.
SW-2- Same as SE-2.

XRF ANALYSIS RESULTS

DOUGLAS CREEK WASTE ROCK
PA NO. 20-503

MDEQ AMRB/PIONEER 1/12/96

Mine Name: Douglas Creek Waste Rock PA No. 20-503
XRF Field Analyses
Results in PPM

XRF SAMPLE I.D.	CrHI	K	Ca	Tl	CrLO	Mn	Fe	Co	Ni	Cu	Zn	As	Se
20-503-WR1A		27358.2	10696.8	2216.3		1471.06 *	32865.1				61.5765 *	1176.97	
20-503-WR1B		24908.8	8641.35	2128.32			33778.4				277.283	3736.85	
20-503-WR1C		32762.5	4169.55	2322.42		971.766 *	35191.4				125.325 *	1830.77	
20-503-WR1D		20266.6	2291.87	2587.69			49967.2	514.686 *			97.2272 *	5446.91	
20-503-WR1E		9050.14	12960.6	2545.75		745.515 *	26897.8	481.478 *			85.121 *	151.398	
20-503-WR1-COMP		32459.7	5536.81	2326.01		761.939 *	38553.2				111.431 *	2794.34	
20-503-WR1B-DUP		25011.9	8156.21	2350.91			32948.4				160.063 *	1984.84	

XRF SAMPLE I.D.	Sr	Zr	Mo	Hg	Pb	Rb	Cd	Sn	Sb	Ba	Ag	U	Th
20-503-WR1A	295.298	143.417				200.684				1163.52	92.5187 *		16.7465 *
20-503-WR1B	215.296	119.873			270.732	168.01			129.313 *	1770.33	135.535 *		17.3285 *
20-503-WR1C	156.06	152.656			223.225	215.225			112.554 *	888.217	190.371 *		13.0426 *
20-503-WR1D	231.609	147.806			301.037	255.127			313.079	741.155	238.398 *		
20-503-WR1E	410.686	147.848				68.7556				1531.23			14.3955 *
20-503-WR1-COMP	237.483	159.288			183.287	230.078			162.895 *	1130.79	127.007 *		
20-503-WR1B-DUP	241.473	127.121			284.3	188.339			128.795 *	1574.16	163.008 *		14.9228 *

ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS) SCORESHEET

DOUGLAS CREEK WASTE ROCK
PA NO. 20-503

AIMSS SCORESHEET

SITE NAME: DOUGLAS CK WASTE RK
PA NUMBER: 20-503

LINE NO.				
		GROUNDWATER PATHWAY		
1	GW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A		CONTAINMENT		20
3B		GW DEPTH		20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	400
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	400
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	52.776
6	GW - TARGETS	WELLS - 1 MI. x 2.5		12.5
7		WELLS - 1 TO 4 MI		41
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	53.5
10		**GROUNDWATER SCORE**	LINES 4 x 5 x 9	1129406
		SURFACE WATER PATHWAY		
11	SW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
12		EXCEEDENCES		0
13A		CONTAINMENT		20
13B		DISTANCE TO SW		20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	400
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	400
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	53.812
16	SW - TARGETS	DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		2
18		WETLANDS		10
19		FISHERY		1
20		RECREATION		0
21		IRRIGATION/STOCK		0
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 THRU 22	13
24		**SURFACE WATER SCORE**	LINES 14 x 15 x 23	279822
		AIR PATHWAY		
25	AIR - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
26A		CONTAINMENT		10
26B		DISTANCE TO POPULATION		5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	50
27		LIKELIHOOD SCORE	LINES 25 + 26C	50
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.156
29	AIR - TARGETS	POPULATION - 4 MILES		30
30		NEAREST RESIDENCE		0
31		WETLANDS		10
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 THRU 33	40
35		**AIR PATHWAY SCORE**	LINES 27 x 28 x 34	312
		DIRECT CONTACT PATHWAY		
36	LIKELIHOOD OF EXPOSURE	OBSERVED EXPOSURE		50
37A		ACCESSIBILITY		20
37B		DISTANCE TO POPULATION		5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	100
38		LIKELIHOOD SCORE	LINES 36 + 37C	150
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.154
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE		1
41		NEAREST RESIDENCE		0
42		RECREATIONAL USE		5
43		TARGETS SCORE	SUM LINES 40 THRU 42	6
44		**DIRECT CONTACT SCORE**	LINES 38 x 39 x 43	139
45	**TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE** (LINES 10 + 24 + 35 + 44) / 100,000			**14.10**

SITE NAME: DOUGLAS CK WASTE RK
PA NUMBER: 20-503

LINE NO.		SITE SAFETY		
1	THREAT	ACCESSIBILITY		20
2		OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	50
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	75
5		HAZ. STRUCTURES	40 EA.	80
6		EXPLOSIVE HAZARD		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 THRU 7	205
9		POPULATION - 1 MILE		1
10	TARGETS	NEAREST RESIDENCE		0
11		RECREATIONAL USE		5
12		TARGETS SCORE	SUM LINES 9 THRU 11	6
13		**SITE SAFETY SCORE**	(LINES 1 x 8 x 12) / 1,000	**24.60**

PRINCETON

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY
SITE INVESTIGATION LOG SHEET

Mine/Site Name: PORT ROYAL MILL TAILINGS **PA#:** 20-016

Date: October 17, 1995 **Time:** 1000-1650

Field Team Leader: Tuesday, Pioneer

Sampling Personnel: Bisch, Flammang, Pioneer

Visitors: None

Weather/Seasonality Observations: Rainy; cool; wet summer.

Photographic Log (Photo No.'s/Video Tape Number)**:** #22: Overview of site.

General Comments/Observations (not covered specifically in attached Inventory Forms)**:** Site also known as Royal/Sunday Mines. Most floodplain and wetland tailings are well vegetated and hard to find. Several attempts to rework tailings are apparent. Mine site was not investigated, appears to have current mining activity. Several discharging adits.

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Tailings are revegetating naturally; assist and amend where still unvegetated.

I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): PORT ROYAL MILL TAILINGS **PA#:** 20-016

Legal Description: **T** 8N **;R** 12W **;Sec.** 32 **,** NE **1/4**___**1/4**___**1/4**
;Sec. 33 **,** NW **1/4** NW **1/4**___**1/4**

County: Granite **Mining District:** Princeton

Latitude: N 46° 22' 00" **Longitude:** W 113° 07' 00"

Primary Drainage Basin and Code: Flint Creek/17010202
Secondary Drainage Basin: Royal Gold Creek/Boulder Creek

USGS Quadrangle map name(s): Maxville/Pikes Peak

Mine Type/Commodities: Tailings/Gold

Activity Status: Active___, Inactive/Exploration___, Abandoned X **.**

Ownership status: Known Y X **N___; private/public?** Public
Owner, Agent, or Contact (Include address and phone when available)**:** USFS, Deerlodge National Forest; mines are privately owned.

Relationship to other mines/sites in the area/district: Approximately 1 mile northeast of Nonpareil (20-012); downstream of Port Royal/Sunday Mines

Regulatory Status (Activity by other agencies)? Hardrock permits? Past Reclamation Activities? Unknown

General site features: Elevation 6700'-6900' **, Slope** 20° **,**
Aspect Southwest

Land use: Mining___, Recreational X **, Residential___, Urban___, Agricultural___, Other(Specify)**

Area of disturbed/unvegetated lands? 6-10 (total) **acre(s).**
Site Dimensions: 500 feet x 500 feet

Predominant vegetation types: Fir/pine forest; willows in wetlands

Access: roads - good (paved)___, poor (maintained dirt road)___, 4wd X **, trail___.**
Other logistical considerations (proximity to other sites). 1 mile from Nonpareil

Well logs within 1 mile radius; (Attach MBMG Well Log Printout(s): There are no well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also note presence of radioactive minerals). Granite and granite porphyry country rocks. Royal Gold Creek flows southwest through tailings; approximately 1/2 mile below last obvious tailings deposit the creek meets Boulder Creek, which flows northwest approximately 10 miles to confluence with Flint Creek.

Mining/milling history, ore type/tenor, host rock, gangue: Royal mill was a 10-stamp mill with amalgamating plates. Tailings were not impounded, but turned into the gulch below, settling in flat one mile below the mine. In 1905, a plant with 6, 50 ton cyanide tanks were installed in flats below the mine. The mine consisted of five drift tunnels driven one above the other. Lode is a fissure vein; vein is 4" to 2' wide and composed of quartz, pyrite, and galena.

Mine Operation?

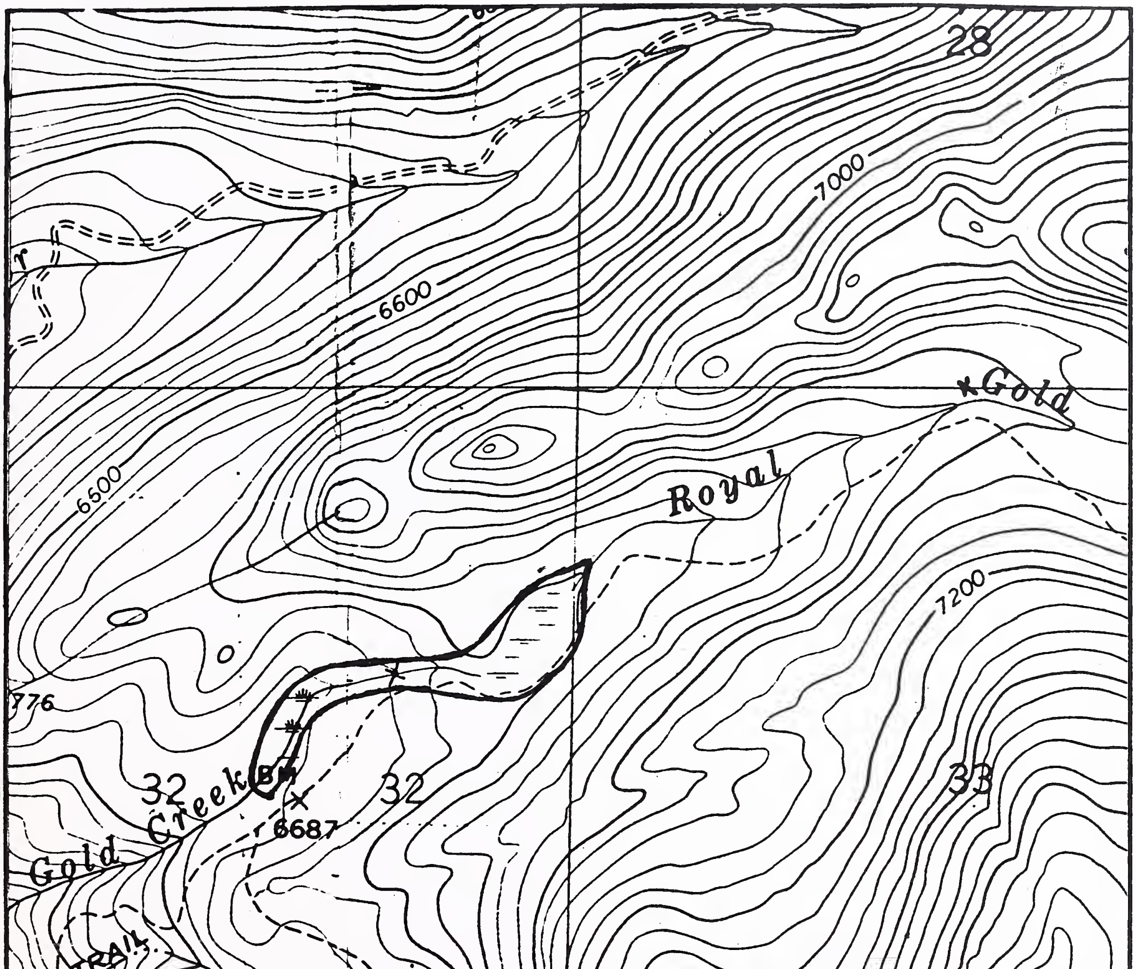
Shafts -	**Yes**___,	**No** X ,	**#** ____,	**Comment**
Adits -	**Yes** X ,	**No**___,	**#** ____,	**Comment** 5 drift tunnels
Pits -	**Yes**___,	**No** X ,	**#** ____,	**Comment**
Placers -	**Yes**___,	**No** X ,	**#** ____,	**Comment**
Other -	**Yes**___,	**No** X ,	**#** ____,	**Comment**

Mill Operation? **Yes** X , **No**____. **If yes answer the next three questions:**

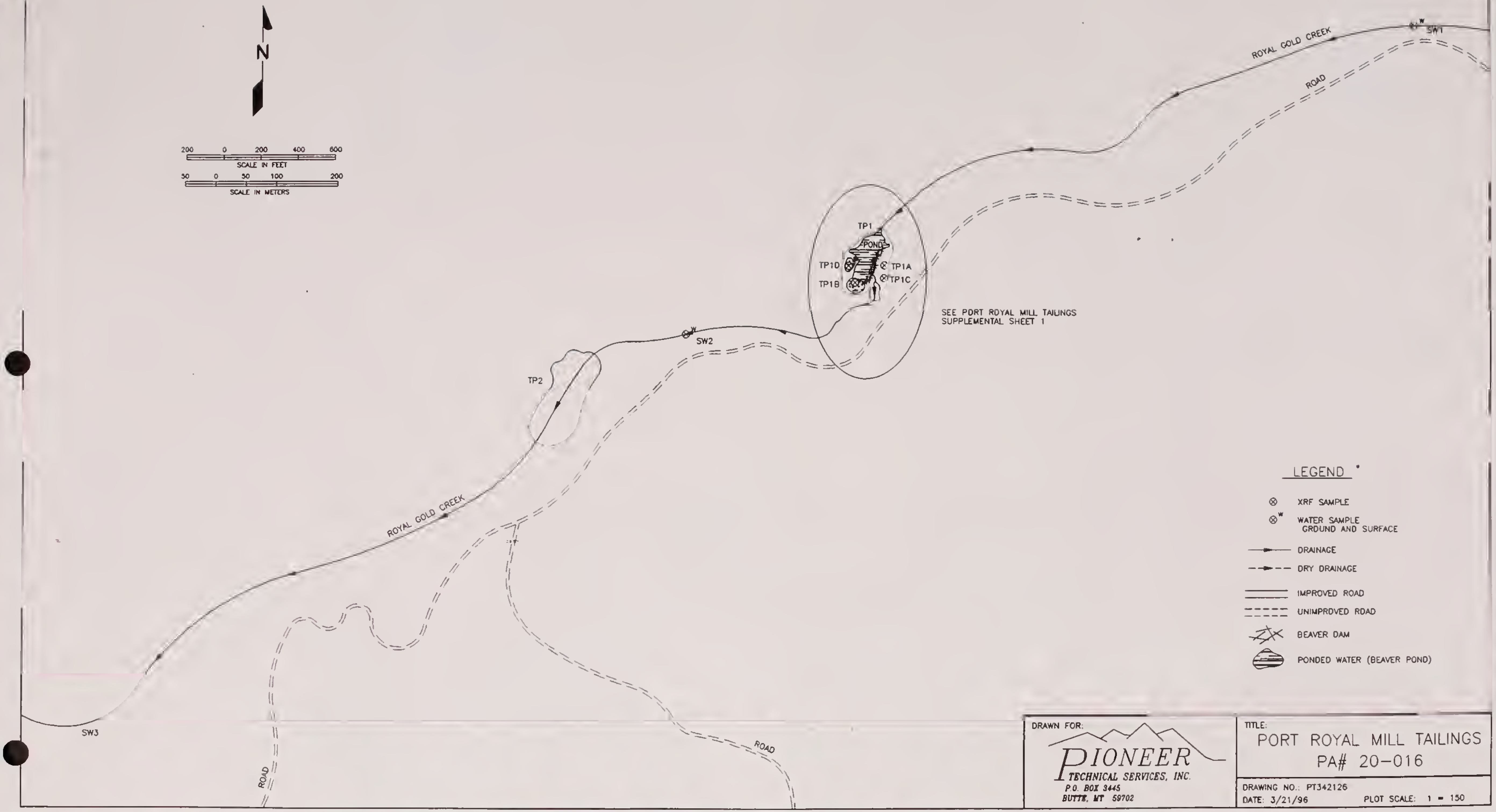
Period(s) of Operation: 1892-1906

Origin of Ore Milled - Custom Mill___ **Dedicated Mill** X ; **Number and names of mines that supplied mill feed:**

Process? Hg-amalgam, CN$^-$ leach (vat, heap), floatation, smelting? Royal Mill was 10-stamp, amalgamation and concentration, and 4 vanners were used for concentrating. A CN leach mill reworked the tailings in 1905.



PORT ROYAL MILL TAILINGS, P.A. NO. 20-016
T08N, R12W, SECTION 32
SCALE: 1" = 1000'

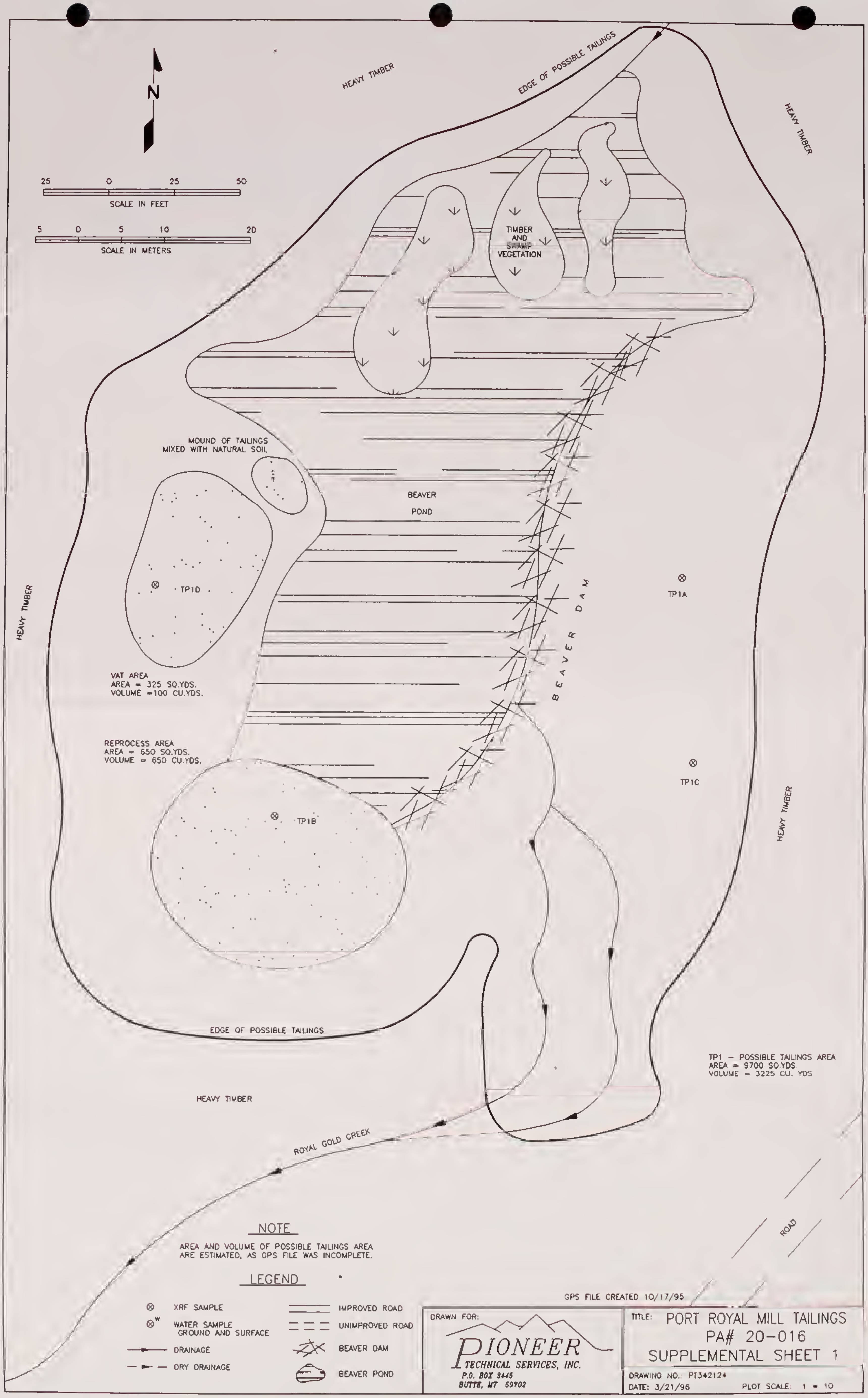


DRAWN FOR:

PIONEER
TECHNICAL SERVICES, INC.
P.O. BOX 3445
BUTTE, MT 59702

TITLE:
PORT ROYAL MILL TAILINGS
PA# 20-016

DRAWING NO.: PT342126
DATE: 3/21/96
PLOT SCALE: 1 = 150



NOTE

AREA AND VOLUME OF POSSIBLE TAILINGS AREA
ARE ESTIMATED, AS GPS FILE WAS INCOMPLETE.

LEGEND

⊗ XRF SAMPLE
$\otimes^{W}$ WATER SAMPLE GROUND AND SURFACE
—►— DRAINAGE
– ► – – DRY DRAINAGE
—— IMPROVED ROAD
– – – UNIMPROVED ROAD
BEAVER DAM
BEAVER POND

GPS FILE CREATED 10/17/95

DRAWN FOR:
PIONEER
TECHNICAL SERVICES, INC.
P.O. BOX 3445
BUTTE, MT 59702

TITLE: PORT ROYAL MILL TAILINGS
PA# 20–016
SUPPLEMENTAL SHEET 1

DRAWING NO.: PT342124
DATE: 3/21/96
PLOT SCALE: 1 = 10

II. INFORMATION COLLECTED ON SITE

A. SOLID MATRIX WASTE CHARACTERIZATION

1. **Waste Characteristics** - *Use table on following page.*

Unique source identification: (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TP); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures/vessels sound, are runon/runoff controls in place, are wastes covered or vegetated, pond liners intact?

2. **TAILINGS IMPOUNDMENTS** - *If tailings impoundments are also present, complete the following questions.*

Describe the tailings grain size distribution (approximate % sand, silt, & clay): Fluvially deposited tailings, well mixed with no stratification. Sizes range from clay to sand depending on depositional energy.

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): Most floodplain tailings are 1 foot deep or less. In CN reprocess area, tailings are sandy and 3 feet deep.

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): Dry, except where flooded by beaver ponds/wetlands.

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): No impoundment

Comments on potential for mitigation: Minor work needed to revegetate tailings that are not self-vegetated (approximately 20% of total area).

SOURCE INVENTORY FORM

SAMPLERS: Tuesday, Bisch

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd³)	LOCATION/DESCRIPTION	CONTAIN-MENT	pH SU (D/S)*	RADIO-ACTIVITY (mR/HR)	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
TP-1A-1	TAIL	3,875*	Tailings in upper wetland area, northeast side, floodplain area	None	6.3	0.03	20-016-TP-1	10/18/95 1615	T-Metals, ABA, Cyanide
TP-1B	TAIL		Tailings in upper wetland area, southwest side, reprocess area	None	6.8	0.04	20-016-TP-2	10/18/95 1615	T-Metals, ABA, Cyanide
TP-1C-1	TAIL		Tailings in upper wetland area, southeast side, floodplain area	None	6.4	0.03			
TP-1D	TAIL		Tailings in upper wetland area, west side, reprocess area	None	6.8	0.04			
TP-1A-2	TAIL		Underlying soil at TP-1A	N/A	5.0	0.04	N/A	N/A	XRF Analysis
TP-1C-2	TAIL		Underlying soil at TP-1C	N/A	6.4	0.03	N/A	N/A	XRF Analysis

* pH readings were taken directly on-site (Kelwey Meter).

Comments or deviations from SOPs: 20-016-TP-1 is a composite of TP-1A and TP-1C (floodplain). 20-016-TP-2 is a composite of TP-1B and TP-1D (reprocess area). Background sample was collected at the Jackson Park Mine (20-027-SS-1) during the 1993 investigation. *Depth and extent of tailings covered by pond is unknown, 1" depth was used to calculate volume, and average depth at sample points along edge of pond.

B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes____, No_X_, Number:____ Identification:________

Filled shafts: Yes____, No_X_, Number:____ Identification:________

Seeps/Springs: Yes____, No_X_, Number:____ Identification:________

Groundwater wells within 4 miles?: Yes_X_, No___;
Number of well logs:_13___

Distance to nearest well used for drinking:
___<1,000 ft;___1,000 ft to 0.5 miles;_X_>0.5 miles.

Sample types: Flowing adits (AD); filled shafts (SH); Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?
Definite____, **Probable**____, **Possible**____, **Unlikely**_X__.
Low metals; tailings in surface water and floodplain.

Approximate Depth to Groundwater:_X_<25 ft;___ 25 - 100 ft;___ >100 ft.

Other observations/notes: N/A

GROUNDWATER INVENTORY FORM

SAMPLERS: ____________________

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SOURCE	FLOW* cfs/gpm	pH SU	SC µS/cm @ 25°C	Eh mV	Temp °C	ALK. mg/L as $CaCO_3$	Depth ft	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
No samples were taken.												

FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): ____________________

C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/run-off) and directions on sketch maps.

Flowing streams: Yes X, No___, Name(s): Royal Gold Creek

Dry streambeds: Yes___, No X, Name(s):___

Other surface water: Yes X, No___, Name(s)/Description: Beaver ponds on top of tailings

Waste materials within any floodplain: Yes X, No___ **Source ID(s):** TP-1

Approximate Flood frequency? X 1 yr, ___10 yr, ___100 yr

Estimated seasonal flow of stream(s) (cfs/gpm)? 1.5 cfs
High Flow: 3 cfs, **Average Flow:** 1.5 cfs

Distance between waste source(s) and nearest surface water body (ft)? 0 feet

Surface water draining onto or through waste sources: Yes X, No___,
Describe: Creek flows through tailings.

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)
Fishery, irrigation, agriculture, T&E Bald Eagle, and Bull Trout in Boulder Creek; Wetlands in Royal Gold and Boulder Creeks.

Observed erosional/sedimentation/stream turbidity problems? Yes X, No___. **Distance downstream (ft)?** 0-500___; 500-1,000___; >1,000 X.
Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present): Tailings in stream banks 2,000 feet downstream.

SURFACE WATER INVENTORY FORM

SAMPLERS: Bisch

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SAMPLE LOCATION	pH SU	SC $\mu S/cm$ @ 25°C	Temp °C	ALK. mg/L as $CaCO_3$	Flow* cfs/gpm	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
SW-1	SW	Upstream of tailings in Royal Gold Creek	7.52	53	7.0	15	1.5 cfs (E)	20-016-SW-1	10/17/95 1055	T-Metals, TDS, Hardness, Cl, SO4
SE-1	SE	Upstream of tailings in Royal Gold Creek	N/A	N/A	N/A	N/A	N/A	20-016-SE-1	10/17/95 1055	T-Metals
SW-2	SW	Just below tailings/ wetlands deposit in Royal Gold Creek	7.83	53	4.3	6	1.7 cfs (E)	20-016-SW-2	10/17/95 1515	T-Metals, TDS, Hardness, Cl, SO4
SE-2	SE	Just below tailings/ wetlands deposit in Royal Gold Creek	N/A	N/A	N/A	N/A	N/A	20-016-SE-2	10/17/95 1515	T-Metals
SW-3	SW	Above Nonpareil in Royal Gold Creek	8.52	56	5.2	16	1.0 cfs (E)	20-016-SW-3	10/17/95 1630	T-Metals, TDS, Hardness, Cl, SO4
SE-3	SE	Above Nonpareil in Royal Gold Creek	N/A	N/A	N/A	N/A	N/A	20-016-SE-3	10/17/95 1630	T-Metals

FLOW: Estimated (E) or Measured (M)?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): ____

D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

AMD Characteristics:

Presence and abundance of sulfides? (*SO_3*)

Presence of evaporative salt deposits? (*ESD*)

Discolored or turbid seepage? (*SPG*)

Presence of long filamentous algae in drainages, mosses in moist areas?

Presence of ferric hydroxide precipitates? (*FEOX*)

Presence of burned or stressed vegetation? (*VEG*)

pH ≤ 5.0 (*pH*)

General Potential for AMD Mitigation:

Area available for treatment (acres)? Approximately 20 acres including areas already covered with tailings and vegetated

Wetlands present: Yes X **, No**____**, Describe:** Tailings ponds are now wetlands.

Carbonate rocks/soils: Yes___**, No** X **, Describe:**____

E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10___**; 10-30** X **; 30-100**___**; 100-300**____**; 300-1,000**____**; 1,000-3,000**____**; 3,000-10,000**____**; 10,000 or greater**___**; Comments** Princeton

Nearest residence:___**<1,000 ft;** X **1,000 ft - 0.5 miles;**___**>0.5 miles.**

For each source (table next page):

Available fine materials? Surface area?

Uncovered and unvegetated? Wet or dry?

Overall dust propagation potential:
observed high moderate low none

ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

SAMPLERS: Tuesday, Bisch

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LIST)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/HIGH/MODERATE/LOW/NONE)
TP-1 (FP)	FEOX	Wet	87,300	4,365	Yes	None
TP-1 (R&V)	FEOX	Dry	8,775	8,775	Yes	None

Notes and Clarifications: FP - Floodplain area; R&V - Reprocess and vat area

F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes_____, No_X_
Describe:____

Population within 1 mile: 1-10_X_; 10-30___; 30-100___; 100-300___; 300-1,000___; 1,000-3,000___; 3,000-10,000___; 10,000 or greater___;
Comments____

Evidence of recreational use on site: Yes___, No_X_, Describe:________
____

Accessibility (check each that apply):_X_Easily accessible - no fences, gates, or warning signs;___Moderately Accessible - barbed wire fences, road gated, or signs posted;___Difficult Access - chain-link fence, road gated and locked, site guarded (does not include locked or manned access points located more than 0.5 miles from the actual site).

Sensitive environments on-site or adjacent to site:
State or National Parks - Yes___, No_X_, Comment________________
Wilderness Area - Yes___, No_X_, Comment________________
T&E Species Habitat - Yes_X_, No___, Comment_Bald Eagle, Bull Trout_
Bat Habitat - Yes___, No_X_, Comment________________

Primary Drainage_X_; Secondary Drainage___; No Information___:
Riparian Habitat Quality - High___, Medium_X_, Low___
Wetlands Frontage - High___, Medium_X_, Low___
Fisheries Habitat and Species Classification - _3_
Sport Fishery Classification - _4_

G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes___, No_X_, Number_____, types and locations:____
____

Hazardous structures: Yes___, No_X_, Number_____, types and locations:_
____

Unstable highwalls, pits, trenches, slopes: Yes___, No_X_, Number_____, types and locations:____

Unstable waste piles, impoundments, undercut banks: Yes_X_, No_____, Number_1_, types and locations:_Undercutting of tailings in on-going_

Fire and/or Explosion hazards: Yes___, No_X_, Explain:________________

Bibliography

MBMG, Well Log Database, July 14, 1994.

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MDHES/SHWB, Superfund Basics, Overview and Accomplishments of Superfund in Montana 1983-1993, November 1993.

MDEQ/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for Port Royal, Prepared by Northern Engineering and Testing, August 4, 1987.

USGS, Geology and Ore Deposits of the Philipsburg Quadrangle, Montana, Professional Paper 78, Written by William Harvey Emmons and Frank Cathcart Calkins, 1913.

USGS, Topographic Map, Maxville and Pikes Peak, Montana, 7 1/2 minute Quadrangles, 1971.

LABORATORY ANALYTICAL DATA

PORT ROYAL MILL TAILINGS
PA NO. 20-016

Port Royal Mill Tailings PA# 20-016
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 10/17/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
20-016-SE-1	8.8 JX	6.9 UJ	49.3	1.9	1100	2.5 UJ	2.9 UJ	51.2 J	8400	369 J	1530	841	0.17 J	3.7 UJX	1.2 U	275	NR
20-016-SE-2	7.4 JX	8.8 JX	45.5 J	2.0 J	938	2.2 UJ	2.5 U	32.8 JX	4210 JX	143 JX	812	1300 JX	0.084	3.1 U	1.9 JX	652 J	NR
20-016-SE-3	15.2 UJX	31.8 JX	84.5 J	5.8 J	5330	4.7 UJ	6.9	206 JX	13400 JX	817 JX	2170	910 JX	1.6	6.8 U	7.5 JX	1000 J	NR
20-016-TP1	16.8 JX	63.6 J	78.2	3.8	905	2.6 UJ	3.0 UJ	924 J	11800	2050 J	580	255	11.6 J	3.8 UJX	17.8	1480	1.08
20-016-TP2	12.7 JX	54.0 J	80.4	2.4	701	1.8 UJ	2.0 UJ	429 J	9610	1290 J	644	1070	1.3 J	2.6 UJX	4.1	786	<0.282
BACKGROUND	5 U	17 JX	122	0.8 J	NR	34.2 J	10.4 J	34.6	23500 J	38 J	NR	1040 J	0.06 J	36 J	NR	106 J	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
20-016-TP1	0.02	0.62	2.63	2.01	0.02	<0.01	<0.01	0	2.63	2.63	5.52	0.47	2.70	5.67
20-016-TP2	0.01	0.31	3.14	2.82	0.01	<0.01	<0.01	0	3.14	3.14	6.59	0.23	3.63	7.63

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
20-016-SW-1	1.9	1.5 U	3.2	0.046 U	7250	8.7 U	8.3 U	5.0 J	34.4 J	1.4	585	4.5 J	0.17 JX	16.9 U	0.34 JX	16.0	20.5
20-016-SW-2	1.9 U	1.5 U	4.5	0.046 U	7270	8.7 U	8.3 U	6.5 J	176 J	2.9	584	32.5 J	0.22 JX	16.9 U	0.25 JX	12.6	20.6
20-016-SW-3	1.9 U	1.5 U	4.2	0.046 U	7860	8.7 U	8.3 U	5.9 J	130 J	2.3	638	7.9 J	0.20 JX	16.9 U	0.53 JX	15.9	22.3

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
20-016-SW-1	28	< 5	5	NR	NR
20-016-SW-2	32	< 5	6	NR	NR
20-016-SW-3	41	< 5	6	NR	NR

Legend

SE-1- Upstream of tailings in Royal Gold Creek.
SE-2- Just below tailings/wetlands deposit in Royal Gold Creek.
SE-3- Above Nonpareil in Royal Gold Creek.
TP1- Composite TP1A, TP1C (floodplain).
TP2- Composite TP1B and TP1D (reprocess area).
BACKGROUND- Taken from Jackson Park Mine (20-027-SS1) (1993 data).
SW-1- Same as SE-1.
SW-2- Same as SE-2.
SW-3- Same as SE-3.

XRF ANALYSIS RESULTS

PORT ROYAL MILL TAILINGS
PA NO. 20-016

MDEQ AMRB/PIONEER 1/12/96

Mine Name: Port Royal Mill Tailings PA No. 20-016
XRF Field Analyses
Results in PPM

XRF SAMPLE I.D.	CrHI	K	Ca	Ti	CrLO	Mn	Fe	Co	Ni	Cu	Zn	As	Se
20-016-TP1A1		12988	2477.3	540.08		371.35 *	8565.4			362.09 *	646.57 *		
20-016-TP1A2		5722.3	5142.5	1295		878.03 *	8536.1				1003.3		
20-016-TP1B1		12779	2373.5	389.33		744.31 *	7380.6			264.39 *	553.16 *		
20-016-TP1C1	273.75	26642	3241.5	1095.6 *			10508		103.93 *	697.77 *	1069.7		
20-016-TP1C2	174.51	13540	8308.3	1653.3	279.71 *		8156.9		104.39 *	78.13 *	423.91 *		
20-016-TP1D1		16167	3023.8	514.92		1061.5 *	9761			324.02 *	464.6 *		
20-016-SED1		8558.3	5191.3	575.3	271.74 *	1253.2 *	12364			95.268 *	254.89 *		

XRF SAMPLE I.D.	Sr	Zr	Mo	Hg	Pb	Rb	Cd	Sn	Sb	Ba	Ag	U	Th
20-016-TP1A1	96.185 *	50.376 *	5.3135 *		697.91	88.728			45.594	253.94		20.973 *	
20-016-TP1A2	148.04 *	122.98 *			36.608 *	19.878 *				163.33		34.277 *	
20-016-TP1B1	88.679 *	41.344 *	7.2725 *		619.44	82.913*			54.064 *	236.5			
20-016-TP1C1	106.39 *	113.14 *	13.114 *		1190.1	215.28				274.54			
20-016-TP1C2	375.72	135.19 *			86.462 *	66.05 *				685.87		17.236 *	
20-016-TP1D1	103.79 *	66.182 *	4.7777 *		900.03	92.499			44.489	276.83	81.907		
20-016-SED1	345.83	84.604 *			340.73	87.218				845.71	84.93 *		

ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS) SCORESHEET

PORT ROYAL MILL TAILINGS
PA NO. 20-016

AIMSS SCORESHEET

SITE NAME: PORT ROYAL MILL TAILS
PA NUMBER: 20-016

LINE NO.				
		GROUNDWATER PATHWAY		
1	GW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A		CONTAINMENT		20
3B		GW DEPTH		20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	400
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	400
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	2.476
6	GW - TARGETS	WELLS - 1 MI. x 2.5		0.0
7		WELLS - 1 TO 4 MI		13
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	13.0
10		**GROUNDWATER SCORE**	LINES 4 x 5 x 9	12875
		SURFACE WATER PATHWAY		
11	SW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		300
12		EXCEEDENCES		50
13A		CONTAINMENT		20
13B		DISTANCE TO SW		20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	400
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	750
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	2.739
16	SW - TARGETS	DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		2
18		WETLANDS		10
19		FISHERY		1
20		RECREATION		5
21		IRRIGATION/STOCK		2
22		T & E SPECIES HABITAT		5
23		TARGETS SCORE	SUM LINES 16 THRU 22	25
24		**SURFACE WATER SCORE**	LINES 14 x 15 x 23	51356
		AIR PATHWAY		
25	AIR - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
26A		CONTAINMENT		1
26B		DISTANCE TO POPULATION		10
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	10
27		LIKELIHOOD SCORE	LINES 25 + 26C	10
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.037
29	AIR - TARGETS	POPULATION - 4 MILES		10
30		NEAREST RESIDENCE		5
31		WETLANDS		10
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		5
34		TARGETS SCORE	SUM LINES 29 THRU 33	30
35		**AIR PATHWAY SCORE**	LINES 27 x 28 x 34	11
		DIRECT CONTACT PATHWAY		
36	LIKELIHOOD OF EXPOSURE	OBSERVED EXPOSURE		0
37A		ACCESSIBILITY		20
37B		DISTANCE TO POPULATION		10
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	200
38		LIKELIHOOD SCORE	LINES 36 + 37C	200
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.034
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE		1
41		NEAREST RESIDENCE		5
42		RECREATIONAL USE		0
43		TARGETS SCORE	SUM LINES 40 THRU 42	6
44		**DIRECT CONTACT SCORE**	LINES 38 x 39 x 43	41
45	**TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE** (LINES 10 + 24 + 35 + 44) / 100,000			**0.64**

SITE NAME: PORT ROYAL MILL TAILS
PA NUMBER: 20-016

SITE SAFETY

LINE NO.				
1	THREAT	ACCESSIBILITY		2
2		OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	0
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	0
5		HAZ. STRUCTURES	40 EA.	0
6		EXPLOSIVE HAZARD		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 THRU 7	0
9		POPULATION - 1 MILE		1
10	TARGETS	NEAREST RESIDENCE		5
11		RECREATIONAL USE		0
12		TARGETS SCORE	SUM LINES 9 THRU 11	6
13		**SITE SAFETY SCORE**	(LINES 1 x 8 x 12) / 1,000	**0.00**

22. Overview of site

JEFFERSON

BASIN

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY SITE INVESTIGATION LOG SHEET

Mine/Site Name: BULLION SMELTER **PA#:** 22-505

Date: September 14, 1995 **Time:** 1435-1630

Field Team Leader: Tuesday, Pioneer

Sampling Personnel: Flammang, Pioneer
Clark, Pioneer
Liebelt, Pioneer

Visitors: None

Weather/Seasonality Observations: Warm; sunny; recent rain; wet spring and summer.

Photographic Log (Photo No.'s/Video Tape Number)**:** #2: WR-1 and foundation; #3: WR-2 near bin; #4: Slag piles (SL-1 sample location); #5: SW-1 downstream sample location; #6: SW-2 upstream sample location. Video Tape No. 1

General Comments/Observations (not covered specifically in attached Inventory Forms)**:** Fairly small site; slag is only waste material of any volume and available to stream.

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Isolate slag from stream, amend, and revegetate. Check on historic status of foundation.

I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): BULLION SMELTER **PA#:** 22-505

Legal Description: T 7N ;R 6W ;Sec. 14 , NE 1/4 SW 1/4 ___ 1/4

County: JEFFERSON **Mining District:** BASIN

Latitude: N 46° 21' 22" **Longitude:** W 112° 17' 40"

Primary Drainage Basin and Code: Basin Creek/10020006
Secondary Drainage Basin: Jack Creek

USGS Quadrangle map name(s): Basin

Mine Type/Commodities: Smelter/Gold, Silver, Copper, Lead, Zinc

Activity Status: Active ___, Inactive/Exploration ___, Abandoned X .

Ownership status: Known Y X N ___; private/public? Public
Owner, Agent, or Contact (Include address and phone when available): Deerlodge National Forest

Relationship to other mines/sites in the area/district: 1 mile down road from Bullion Mine/Mill Complex (22-008)

Regulatory Status (Activity by other agencies)? Hardrock permits? Past Reclamation Activities? Unknown

General site features: Elevation 6600' , Slope 0-15° , Aspect South

Land use: Mining X , Recreational X , Residential X , Urban ___, Agricultural ___, Other(Specify) ___

Area of disturbed/unvegetated lands? 2 acre(s).
Site Dimensions: 450 feet x 230 feet

Predominant vegetation types: Aspen, Lodgepole pine, alder, grass, thistle, juniper

Access: roads - good (paved) ___, poor (maintained dirt road) ___, 4wd X , trail ___.
Other logistical considerations (proximity to other sites). On road to Bullion Mine

Well logs within 1 mile radius; (Attach MBMG Well Log Printout(s): There are no well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also note presence of radioactive minerals). Site is underlain by tertiary Butte quartz/monzonite. Site lies on south fork of unnamed tributary of Jack Creek, which flows west to confluence with Jack Creek 0.25 mile downstream. Jack Creek flows southwest to confluence with Basin Creek 1.25 miles away. Basin Creek flows southeast to confluence with Boulder River approximately 7.5 miles downstream.

Mining/milling history, ore type/tenor, host rock, gangue: No information was found.

Mine Operation?

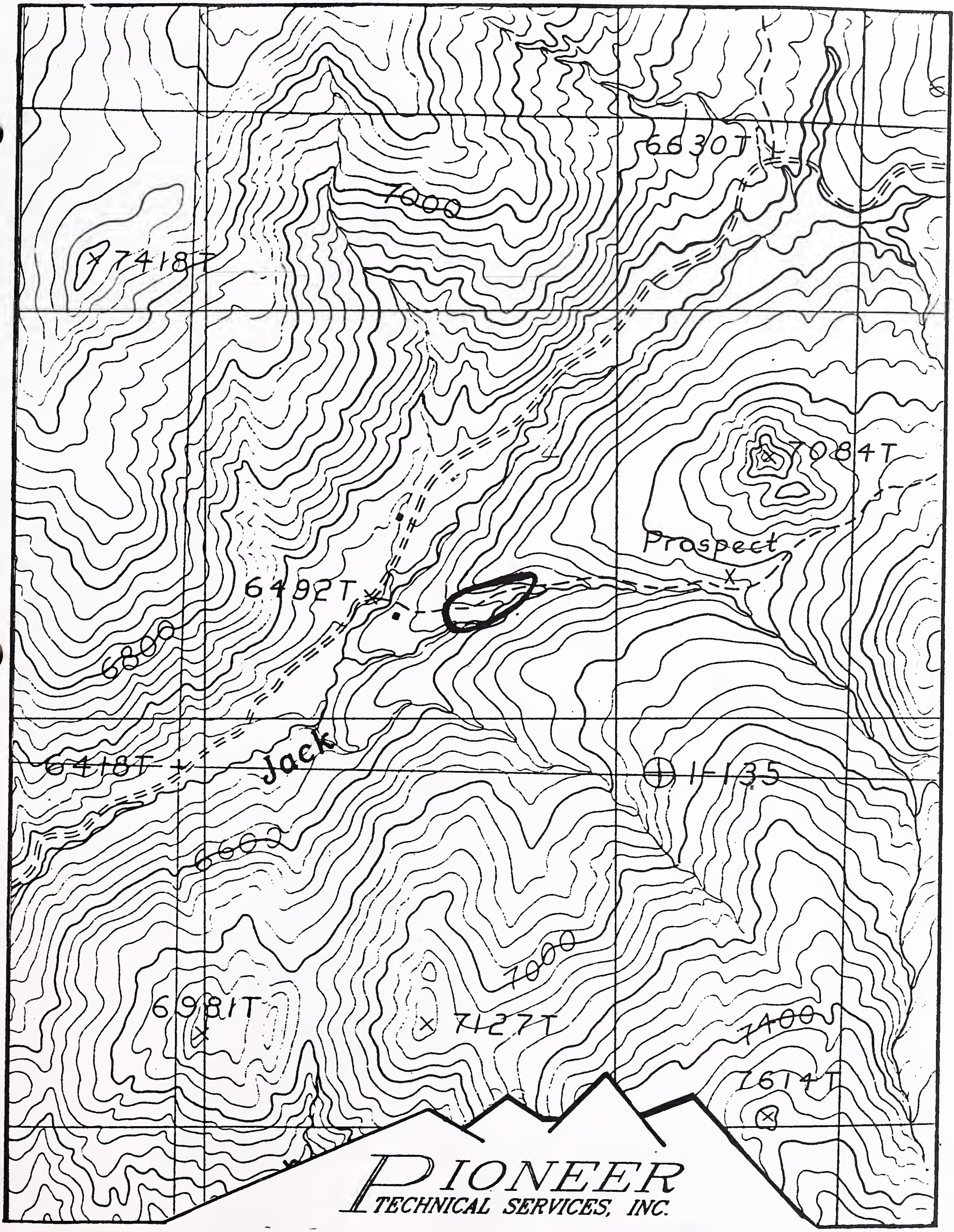
Shafts - **Yes**___, **No** X, **#** ___, **Comment**___
Adits - **Yes**___, **No** X, **#** ___, **Comment**___
Pits - **Yes**___, **No** X, **#** ___, **Comment**___
Placers - **Yes**___, **No** X, **#** ___, **Comment**___
Other - **Yes**___, **No** X, **#** ___, **Comment**___

Mill Operation? **Yes** X, **No**___. **If yes answer the next three questions:**

Period(s) of Operation: 1905 to 1930 (Smelter)

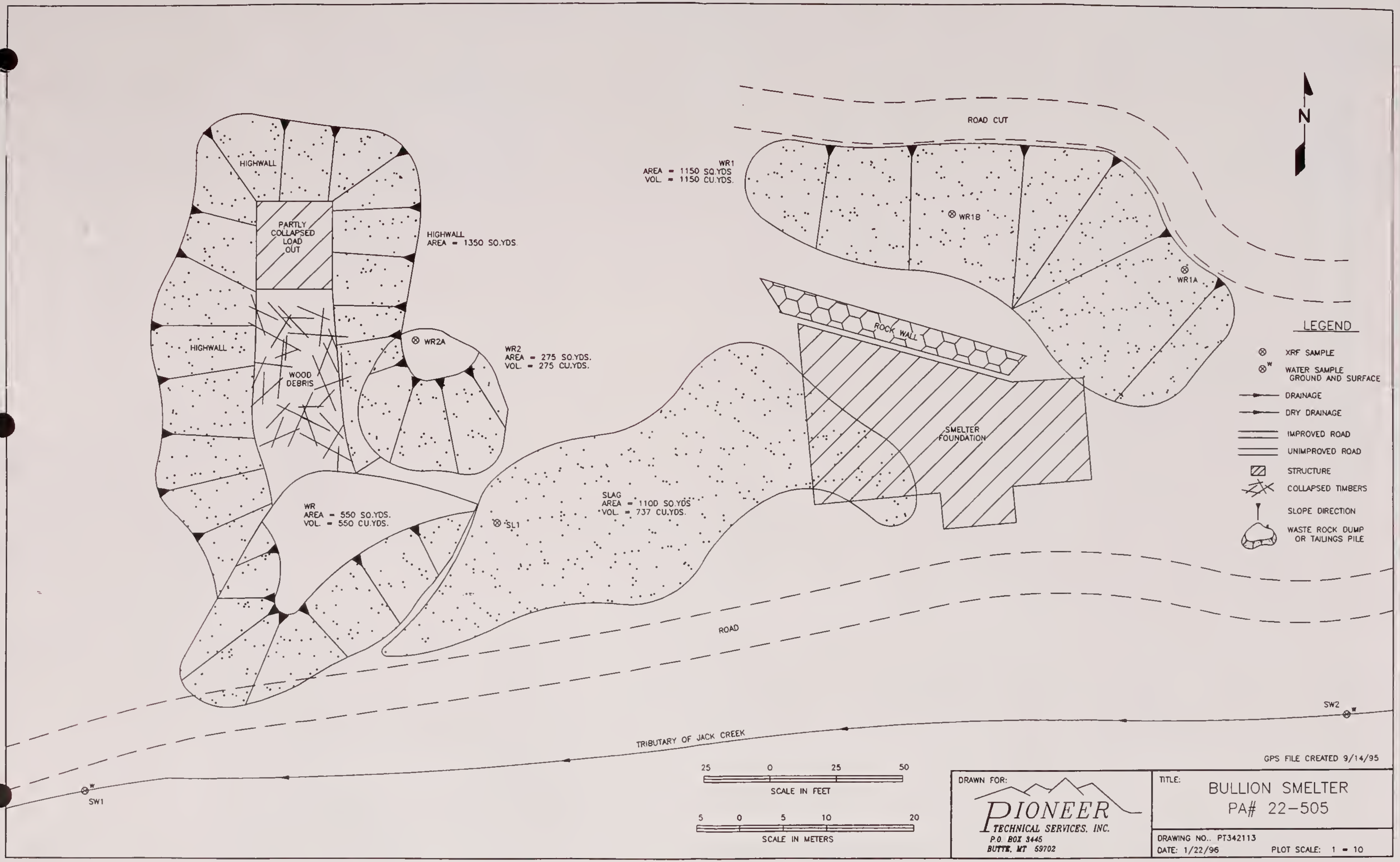
Origin of Ore Milled - Custom Mill___ **Dedicated Mill**___; **Number and names of mines that supplied mill feed:** Unknown

Process? Hg-amalgam, CN⁻ leach (vat, heap), floatation, smelting? In 1905, a 150 ton/day concentrator at the Bullion Mine site and a 200-ton smelter was installed at this site.



PIONEER
TECHNICAL SERVICES, INC.

BULLION SMELTER, P.A. NO. 22-505
T07N, R06W, SECTION 14
SCALE: 1" = 1000'



DRAWN FOR:

PIONEER
TECHNICAL SERVICES, INC.
P.O. BOX 3445
BUTTE, MT 59702

TITLE:
BULLION SMELTER
PA# 22-505

DRAWING NO.. PT342113
DATE: 1/22/96
PLOT SCALE: 1 = 10

II. INFORMATION COLLECTED ON SITE

A. SOLID MATRIX WASTE CHARACTERIZATION

1. **Waste Characteristics** - *Use table on following page.*

Unique source identification: (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TP); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures/vessels sound, are runon/runoff controls in place, are wastes covered or vegetated, pond liners intact?

2. **TAILINGS IMPOUNDMENTS** - *If tailings impoundments are also present, complete the following questions.*

Describe the tailings grain size distribution (approximate % sand, silt, & clay): N/A

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): N/A

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): N/A

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): N/A

Comments on potential for mitigation:

SOURCE INVENTORY FORM

SAMPLERS: Flammang

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd³)	LOCATION/DESCRIPTION	CONTAIN-MENT	pH SU (D/S)*	RADIO-ACTIVITY (mR/HR)	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
WR-1A	SOIL	1,150	Red soil from road cut on east side of site	None	6.2	0.06	N/A	N/A	XRF Analysis
WR-1B	WR		Waste rock above foundation in center of site	None	6.4	0.1	22-505-WR-1	09/15/95 1200	T-Metals, ABA
WR-2	WR	275	Small dump of spilled ore material near bin on west end of site	None	5.5	0.1	N/A	N/A	XRF Analysis
SL-1	SL	737	Slag pile in west center of site	None	6.8	0.13	22-505-SL-1	09/14/95 1550	T-Metals, ABA
SS-1	SOIL		Background soil sample on hilltop above smelter	N/A	6.8	0.04	N/A	N/A	XRF Analysis

* pH readings were taken directly on-site (Kelwey Meter).

Comments or deviations from SOPs: A background sample was also collected at the Bullion Mine (22-008-SS-1) during the 1993 investigation.

B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes___, No_X_, Number:____ Identification:________

Filled shafts: Yes___, No_X_, Number:____ Identification:________

Seeps/Springs: Yes___, No_X_, Number:____ Identification:________

Groundwater wells within 4 miles?: Yes_X_, No___;
Number of well logs: 6

Distance to nearest well used for drinking:
___<1,000 ft; _X_ 1,000 ft to 0.5 miles; ___>0.5 miles.

Sample types: Flowing adits (AD); filled shafts (SH); Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?
Definite____, Probable____, Possible____, Unlikely_X_.
Slag material not soluble; small waste rock pile is high and dry.

Approximate Depth to Groundwater: _X_ <25 ft; ___ 25 - 100 ft; ___ >100 ft.

Other observations/notes: Residence 3/10 mile downstream is part-time; may have a well, but one was not observed during investigation.

GROUNDWATER INVENTORY FORM

SAMPLERS: ____________________

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SOURCE	FLOW* cfs/gpm	pH SU	SC µS/cm @ 25°C	Eh mV	Temp °C	ALK. mg/L as $CaCO_3$	Depth ft	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
No samples were taken.												

*FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): ____________________

____

____

C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/run-off) and directions on sketch maps.

Flowing streams: Yes X, No____, Name(s): Unnamed tributary of Jack Creek

Dry streambeds: Yes____, No X, Name(s):

Other surface water: Yes____, No X, Name(s)/Description:

Waste materials within any floodplain: Yes____, No X Source ID(s):

Approximate Flood frequency?____1 yr,____10 yr,____100 yr

Estimated seasonal flow of stream(s) (cfs/gpm)? N/A
High Flow:________, **Average Flow:**

Distance between waste source(s) and nearest surface water body (ft)?
20 feet; road separates sources from stream.

Surface water draining onto or through waste sources: Yes____, No X,
Describe:

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)
Wetlands, riparian, irrigation, agriculture, fishery

Observed erosional/sedimentation/stream turbidity problems? Yes____, No X. Distance downstream (ft)? 0-500____; 500-1,000____; >1,000____.
Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present):

SURFACE WATER INVENTORY FORM

SAMPLERS: Tuesday, Liebelt

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SAMPLE LOCATION	pH SU	SC µS/cm @ 25°C	Temp °C	ALK. mg/L as $CaCO_3$	Flow* cfs/gpm	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
SW-1	SW	Downstream of site in tributary	7.65	63.6	13.0	8	0.1 cfs (E)	22-505-SW-1	09/14/95 1505	T-Metals, TDS, Hardness, Cl, SO4
SE-1	SE	Downstream of site in tributary	N/A	N/A	N/A	N/A	N/A	22-505-SE-1	09/14/95 1505	T-Metals
SW-2	SW	Upstream of site in tributary	7.68	63.3	11.3	14	0.1 cfs (E)	22-505-SW-2	09/14/95 1535	T-Metals, TDS, Hardness, Cl, SO4
SE-2	SE	Upstream of site in tributary	N/A	N/A	N/A	N/A	N/A	22-505-SE-2	09/14/95 1535	T-Metals

FLOW: Estimated (E) or Measured (M)?

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

AMD Characteristics:

Presence and abundance of sulfides?	*(SO_3)*
Presence of evaporative salt deposits?	*(ESD)*
Discolored or turbid seepage?	*(SPG)*
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	*(FEOX)*
Presence of burned or stressed vegetation?	*(VEG)*
pH ≤ 5.0	*(pH)*

General Potential for AMD Mitigation:

Area available for treatment (acres)? 2 acres

Wetlands present: Yes___, No_X_, Describe:

Carbonate rocks/soils: Yes___, No_X_, Describe:

E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10_X_; 10-30___; 30-100___; 100-300___; 300-1,000___; 1,000-3,000___; 3,000-10,000___; 10,000 or greater___; Comments

Nearest residence:___<1,000 ft;_X (Part-time)_1,000 ft - 0.5 miles; ___>0.5 miles.

For each source (table next page):

Available fine materials? Surface area?

Uncovered and unvegetated? Wet or dry?

Overall dust propagation potential:
observed high moderate low none

ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

SAMPLERS: Flammang

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LIST)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/HIGH/MODERATE/LOW/NONE)
WR-1B	SO3	Dry	10,350	5,175	Yes	Low
WR-2	SO3	Dry	2,475	2,475	Yes	Low
SL-1	None	Dry	9,900	9,900	Yes	Low

Notes and Clarifications:

F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes_____, No_X__, Describe:____________________

Population within 1 mile: 1-10_X_; 10-30___; 30-100___; 100-300___; 300-1,000____; 1,000-3,000____; 3,000-10,000____; 10,000 or greater____; Comments Part-time residence 0.3 mile down tributary

Evidence of recreational use on site: Yes___, No_X_, Describe:________

Accessibility (check each that apply): X Easily accessible - no fences, gates, or warning signs;___Moderately Accessible - barbed wire fences, road gated, or signs posted;____Difficult Access - chain-link fence, road gated and locked, site guarded (does not include locked or manned access points located more than 0.5 miles from the actual site).

Sensitive environments on-site or adjacent to site:
State or National Parks - Yes____, No_X_, Comment__________
Wilderness Area - Yes____, No_X_, Comment__________
T&E Species Habitat - Yes____, No_X_, Comment__________
Bat Habitat - Yes____, No_X_, Comment__________

Primary Drainage_X_; Secondary Drainage___; No Information___:
Riparian Habitat Quality - High___, Medium_X_, Low___
Wetlands Frontage - High___, Medium_X_, Low___
Fisheries Habitat and Species Classification - _4_
Sport Fishery Classification - _4_

G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes___, No_X_, Number____, types and locations:___

Hazardous structures: Yes_X_, No___, Number_1__, types and locations:_ Ore bin above site to the north

Unstable highwalls, pits, trenches, slopes: Yes_X_, No___, Number_1__, types and locations: Highwall behind ore bin

Unstable waste piles, impoundments, undercut banks: Yes____, No_X_, Number____, types and locations:__________

Fire and/or Explosion hazards: Yes___, No_X_, Explain:__________

Bibliography

MBMG, Mines and Mineral Deposits (Except Fuels), Jefferson County, Montana, Bulletin 16, Written by R.N. Roby, W.C. Ackerman, F.B. Fulkerson, and F.A. Crowley, June 1960.

MBMG, Well Log Database, July 14, 1994.

MDFWP, Montana Rivers Information System Rivers Report, Prepared by Montana Natural Resource Information System, July 1995.

MDHES/SHWB, Superfund Basics, Overview and Accomplishments of Superfund in Montana 1983-1993, November 1993.

MDEQ/AMRB Files, Hazardous Materials Inventory Site Investigation Log Sheet for Bullion, Prepared by Pioneer Technical Services, Inc., July 6, 1993.

USGS, Topographic Map, Basin, Montana, 7 1/2 minute Quadrangle, 1985.

LABORATORY ANALYTICAL DATA

BULLION SMELTER
PA NO. 22-505

Bullion Smelter PA# 22-505
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/14/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-505-SE-1	5.6 UJ	5.4	75.4	0.59 U	1690	5.8	6.5	19.4 J	11800	20.8 J	1880	383	0.054	3.3	1.33	85.7 J	NR
22-505-SE-2	5.8 UJ	6.1	106	0.96	1480	7.1	16.0	15.8 J	15000	14.9 J	3090	735	0.048 U	6.9	0.96 U	44.2 J	NR
22-505-SL-1	17.4 J	45.9	299	6.6	97500	14.6	63.6	1940 J	199000	767 J	3900	6390	0.036	2.3 U	30.4	9510 J	NR
22-505-WR-1	7.5 J	371	184	0.58 U	611	16.3	9.9	77.7 J	26000	286 J	5080	348	0.040	10.2	2.4	72.0 J	NR
BACKGROUND	5 U	68 J	344	0.6 U	NR	20.3	22.1	35	35000	39 J	NR	6830	0.08 J	21	NR	188	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
22-505-SL1	0.82	25.6	38.5	12.9	0.38	0.02	0.42	0.62	37.90	37.90	79.59	22.66	19.80	41.59
22-505-WR-1	0.03	0.94	1.29	0.35	0.02	<0.01	0.01	0.00	1.29	1.29	2.71	0.78	0.64	1.34

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Al (ug/L)	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
22-505-SW-1	50.3 JX	2.7 UJ	1.2 U	35.4	0.064 U	6710	9.6 U	10.9 U	4.4 U	90.7	0.58 U	1430	5.2 U	0.16 U	13.9 U	0.56	7.6 U	22 6
22-505-SW-2	54.7 JX	2.7 UJ	1.2 U	35.9	0.064 U	6530	9.6 U	10.9 U	4.4 U	77.3	0.58 U	1430	5.2 U	0.16 U	13 9 U	0.21 U	7.6 U	22 2

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
22-505-SW-1	194	< 5	< 5	NR	NR
22-505-SW-2	50	< 5	6	NR	NR

Legend

SE-1- Downstream of site in tributary.
SE-2- Upstream of site in tributary.
SL1- Slag pile in west-center of site.
WR-1- Subsample of WR1B.
BACKGROUND- From the Bullion Mine (22-008-SS1) (1993 data).
SW-1- Same as SE-1.
SW-2- Same as SE-2.

XRF ANALYSIS RESULTS

BULLION SMELTER
PA NO. 22-505

Mine Name: Bullion Smelter PA No. 22-505
XRF Field Analyses
Results in PPM

XRF SAMPLE I.D.	CrHI	K	Ca	Tl	CrLO	Mn	Fe	Co	Ni	Cu	Zn	As	Se
22-505-SS1		12649	8445.6	2311.9		5393.7	24145			130.43 *	245.24	309.96	
22-505-WR1A		19901	4486	2694.2		876.17 *	72146	1254.3 *			175.58 *	144.98	28.905 *
22-505-WR1B		22087	6122.3	2251.6		603.42 *	34766			85.3 *	136.57 *	401.54	23.352 *
22-505-WR2		31051	2343.2	1075.5			20561			129.73 *	532.22	7851.3	39.402 *
22-505-SLAG		4075.2	66908	406.52 *		5515.3	128668	1317.5 *		846.6	4815.6	116.63 *	58.169 *

XRF SAMPLE I.D.	Sr	Zr	Mo	Hg	Pb	Rb	Cd	Sn	Sb	Ba	Ag	U	Th
22-505-SS1	284.63	160.6			269.98	83.872				486.75			13.792 *
22-505-WR1A	749.07	183.76	29.017			109.73				671.72			18.481 *
22-505-WR1B	391.84	209.86			230.7	150.91				822.32			23.575 *
22-505-WR2	38.371	89.521	16.595 *		5866.4	254.22			1155	129.25	224.34 *		74.663 *
22-505-SLAG	59.165	39.97	13.71 *		288.25				147.62 *	185.17		19.649 *	

ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS) SCORESHEET

BULLION SMELTER
PA NO. 22-505

AIMSS SCORESHEET

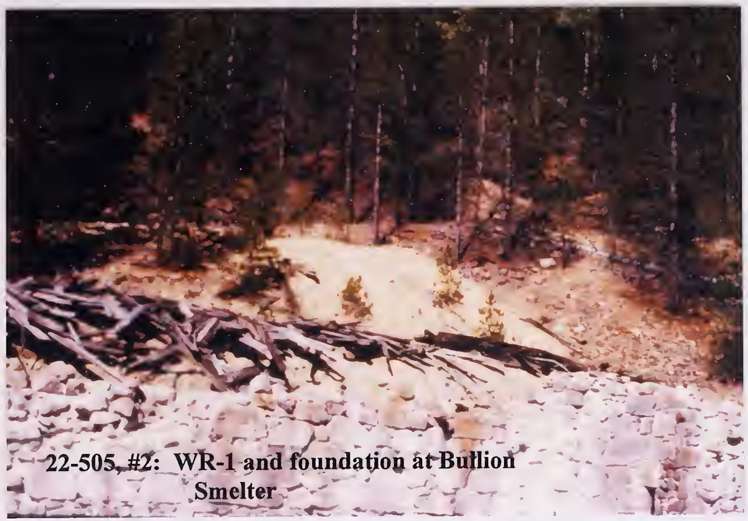
SITE NAME: BULLION SMELTER
PA NUMBER: 22-505

LINE NO.				
		GROUNDWATER PATHWAY		
1	GW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A		CONTAINMENT		20
3B		GW DEPTH		20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	400
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	400
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.779
6	GW - TARGETS	WELLS - 1 MI. x 2.5		0.0
7		WELLS - 1 TO 4 MI		6
8		NEAREST WELL		5
9		TARGETS SCORE	LINES 6 + 7 + 8	11.0
10		**GROUNDWATER SCORE**	LINES 4 x 5 x 9	3428
		SURFACE WATER PATHWAY		
11	SW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
12		EXCEEDENCES		50
13A		CONTAINMENT		20
13B		DISTANCE TO SW		20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	400
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	450
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.884
16	SW - TARGETS	DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		0
18		WETLANDS		10
19		FISHERY		1
20		RECREATION		5
21		IRRIGATION/STOCK		2
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 THRU 22	18
24		**SURFACE WATER SCORE**	LINES 14 x 15 x 23	7160
		AIR PATHWAY		
25	AIR - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
26A		CONTAINMENT		10
26B		DISTANCE TO POPULATION		10
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	100
27		LIKELIHOOD SCORE	LINES 25 + 26C	100
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.016
29	AIR - TARGETS	POPULATION - 4 MILES		1
30		NEAREST RESIDENCE		5
31		WETLANDS		10
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 THRU 33	16
35		**AIR PATHWAY SCORE**	LINES 27 x 28 x 34	26
		DIRECT CONTACT PATHWAY		
36	LIKELIHOOD OF EXPOSURE	OBSERVED EXPOSURE		50
37A		ACCESSIBILITY		20
37B		DISTANCE TO POPULATION		10
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	200
38		LIKELIHOOD SCORE	LINES 36 + 37C	250
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.013
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE		1
41		NEAREST RESIDENCE		5
42		RECREATIONAL USE		2
43		TARGETS SCORE	SUM LINES 40 THRU 42	8
44		**DIRECT CONTACT SCORE**	LINES 38 x 39 x 43	26
45	**TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE** (LINES 10 + 24 + 35 + 44) / 100,000			**0.11**

SITE NAME: BULLION SMELTER
PA NUMBER: 22-505

SITE SAFETY

LINE NO.				
1	THREAT	ACCESSIBILITY		20
2		OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	0
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	75
5		HAZ. STRUCTURES	40 EA.	40
6		EXPLOSIVE HAZARD		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 THRU 7	115
9		POPULATION - 1 MILE		1
10	TARGETS	NEAREST RESIDENCE		5
11		RECREATIONAL USE		2
12		TARGETS SCORE	SUM LINES 9 THRU 11	8
13		**SITE SAFETY SCORE**	(LINES 1 x 8 x 12) / 1,000	**18.40**

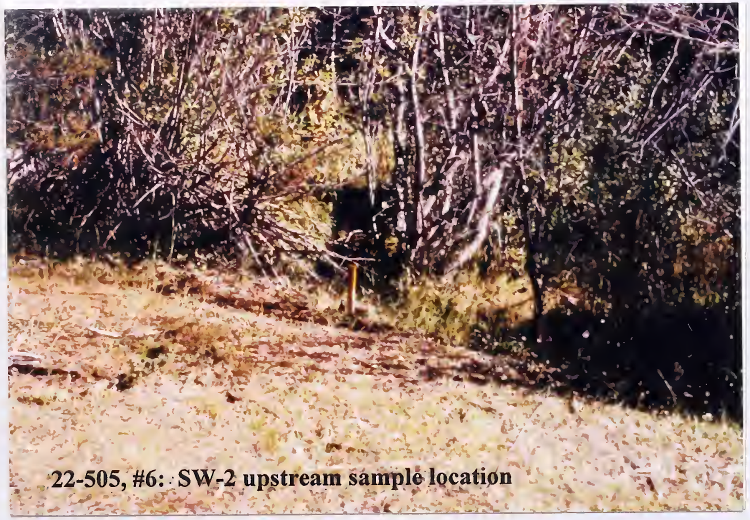


22-505, #2: WR-1 and foundation at Bullion Smelter

22-505, #3: WR-2 near bin

[illegible] Slag piles

22-505, #5: SW-1 downstream sample location



22-505, #6: SW-2 upstream sample location

CLANCY

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY
SITE INVESTIGATION LOG SHEET

Mine/Site Name: FROHNER **PA#:** 22-243

Date: September 15, 1995 **Time:** 1630-2000

Field Team Leader: Tuesday, Pioneer

Sampling Personnel: Flammang, Pioneer
Clark, Pioneer
Liebelt, Pioneer

Visitors: None

Weather/Seasonality Observations: Warm; sunny; recent rain; wet spring and summer.

Photographic Log **(Photo No.'s/Video Tape Number):** #8: WR-1 facing east; #9: WR-2 from base; #10: WR-4 from base; #11: WR-3 from east side of dump; #12: WR-5 from road at base; #13: WR-6 from road above and AD-1 sample location; #14: Adit discharge at lower part of site (AD-2 sample location); #15: WR-7B from road above; #16: WR-7B from road below (dump adjacent to stream); #17: WR-7A from road adjacent; #18: Seepage at base of WR-7. Video Tape No. 1

General Comments/Observations **(not covered specifically in attached Inventory Forms):** Site is in two portions: upper and lower. The upper part of the site consists of several small dumps and one slightly discharging adit; it is mostly on the hillside and not near surface water. The lower part consists of one large dump in the stream and a discharging adit, which has noticeable effect on surface water quality (above vs. below).

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Remove lower waste rock dumps from contacting adit discharge and stream; cover and revegetate dumps. Lower adit discharge will likely require treatment.

I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): FROHNER **PA#:** 22-243

Legal Description: T 8N ;R 5W ;Sec. 15 , NW 1/4 SE 1/4 ___ 1/4

County: JEFFERSON **Mining District:** CLANCY

Latitude: N 46° 26' 28" **Longitude:** W 112° 12' 48"

Primary Drainage Basin and Code: Lump Gulch/10030101
Secondary Drainage Basin: Lump Gulch

USGS Quadrangle map name(s): Chessman Reservoir

Mine Type/Commodities: Hardrock/Gold, Silver, Copper, Lead, Zinc
Activity Status: Active ___, Inactive/Exploration ___, Abandoned X .

Ownership status: Known Y X N ___; private/public? Private
Owner, Agent, or Contact (Include address and phone when available): Unknown

Relationship to other mines/sites in the area/district: Mine is above (west of) Nellie Grant and General Grant Mines.

Regulatory Status (Activity by other agencies)? Hardrock permits? Past Reclamation Activities? Two shafts have been grated and one stope fenced by AMRB.

General site features: Elevation 7200+' , **Slope** 24% ,
Aspect East to Southeast

Land use: Mining X , **Recreational** X , **Residential** ___, **Urban** ___,
Agricultural ___, **Other(Specify)** ___

Area of disturbed/unvegetated lands? 3.4 (upper); 1 (lower) **acre(s).**
Site Dimensions: 300 feet x 500 feet (upper); 300 feet x 150 feet (lower)

Predominant vegetation types: Lodgepole pine, aspen, grasses

Access: roads - good (paved) ___, **poor (maintained dirt road)** ___,
4wd X , **trail** ___.
Other logistical considerations (proximity to other sites). Adjacent (northwest) to and above the Nellie Grant and General Grant Mines

Well logs within 1 mile radius; **(Attach MBMG Well Log Printout(s):** There are no well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings **(Also note presence of radioactive minerals).** Site lies on a tributary to Frohner Meadows, which are less than 1/2 mile away. Water from Frohner Meadows flows east into Lump Gulch. Frohner Group consists of 12 patented claims at the head of Lump Gulch.

Mining/milling history, ore type/tenor, host rock, gangue: Vein is in granite; vein material on dump consists of iron pyrite, some galena and sphalerite in a gangue of dense white quartz. Production records indicate that 161 oz. gold; 7,329 oz. silver; 2,305 lbs. copper; and 26,000 lbs. zinc was recovered from a total of 1,917 tons of ore.

Mine Operation?

Shafts - **Yes** X, **No** ___, **#** 3, **Comment** 2 capped (grated); 1 fenced

Adits - **Yes** X, **No** ___, **#** 5, **Comment** All caved; 2 discharging

Pits - **Yes** ___, **No** X, **#** ___, **Comment** ___

Placers - **Yes** ___, **No** X, **#** ___, **Comment** ___

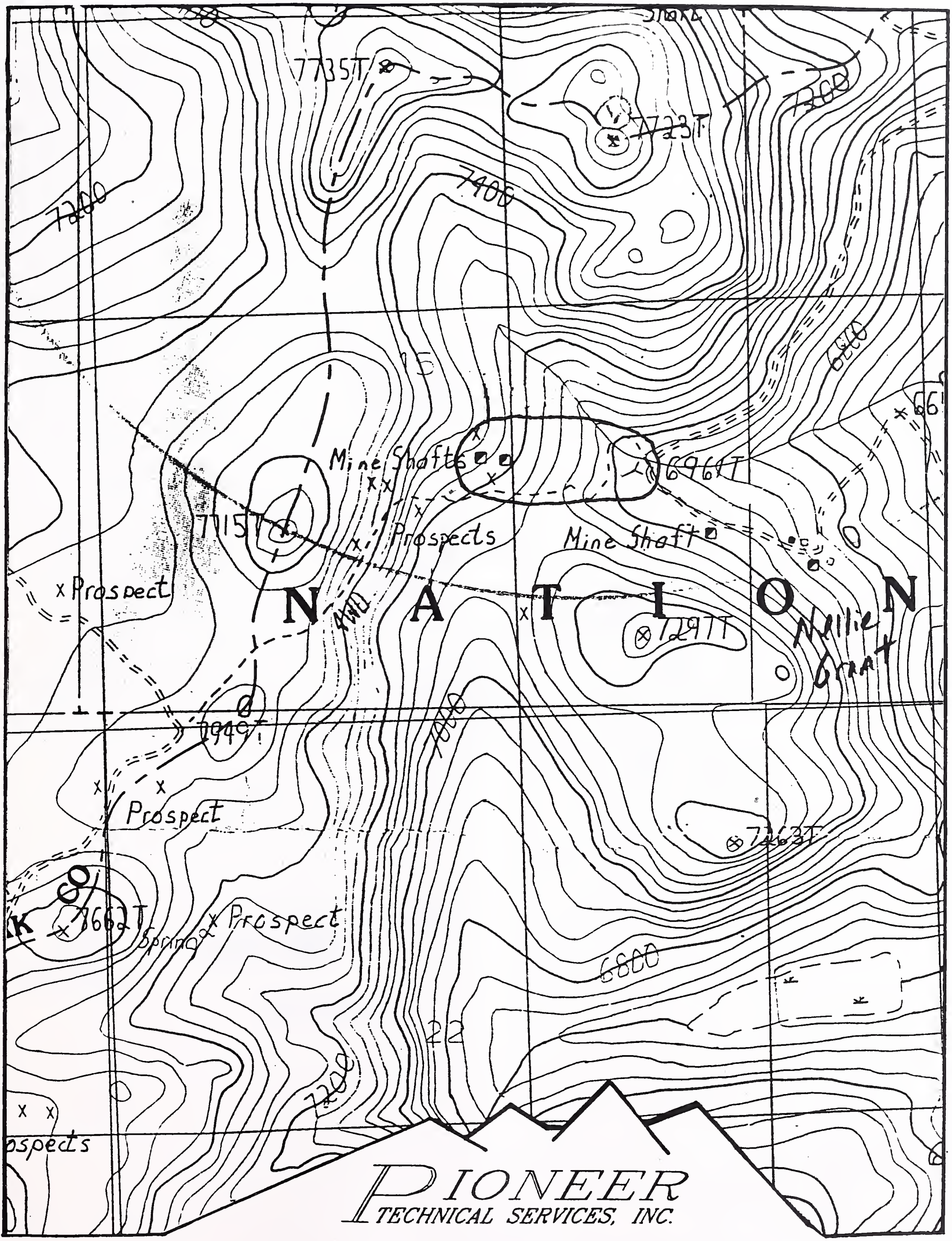
Other - **Yes** X, **No** ___, **#** 1, **Comment** Stope, fenced

Mill Operation? **Yes** ___, **No** X. **If yes answer the next three questions:**

Period(s) of Operation: N/A

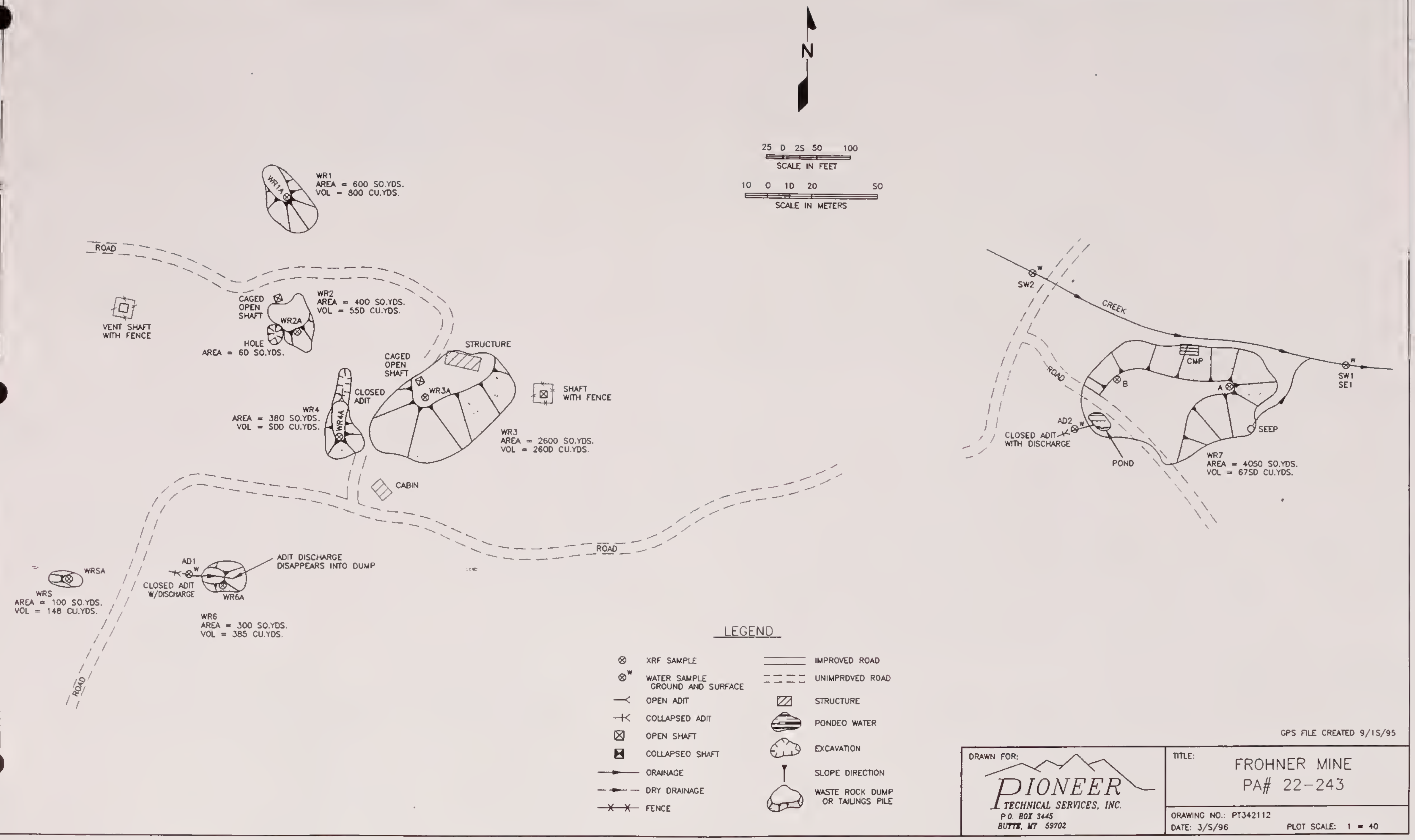
Origin of Ore Milled - Custom Mill ___ **Dedicated Mill** ___; **Number and names of mines that supplied mill feed:** N/A

Process? Hg-amalgam, CN^- leach (vat, heap), floatation, smelting?
N/A



PIONEER
TECHNICAL SERVICES, INC.

FROHNER, P.A. NO. 22-243
T08N, R05W, SECTION 15
SCALE: 1" = 1000'



GPS FILE CREATED 9/15/95

DRAWN FOR:

PIONEER
TECHNICAL SERVICES, INC.
P.O. BOX 3445
BUTTE, MT 59702

TITLE:

FROHNER MINE
PA# 22-243

DRAWING NO.: PT342112
DATE: 3/5/96
PLOT SCALE: 1 = 40

II. INFORMATION COLLECTED ON SITE

A. SOLID MATRIX WASTE CHARACTERIZATION

1. **Waste Characteristics** - *Use table on following page.*

Unique source identification: (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TP); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures/vessels sound, are runon/runoff controls in place, are wastes covered or vegetated, pond liners intact?

2. **TAILINGS IMPOUNDMENTS** - *If tailings impoundments are also present, complete the following questions.*

Describe the tailings grain size distribution (approximate % sand, silt, & clay): N/A

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): N/A

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): N/A

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): N/A

Comments on potential for mitigation: N/A

SOURCE INVENTORY FORM

SAMPLERS: Tuesday, Flammang, Clark, Liebelt

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd^3)	LOCATION/DESCRIPTION	CONTAIN-MENT	pH SU (D/S)*	RADIO-ACTIVITY (mR/HR)	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
WR-1	WR	800	Northern most dump, associated with adit; south end, near top	None	6.2	0.07	22-243-WR-1	09/16/95 1100	T-Metals, ABA
WR-2	WR	550	Lower west dump, associated with upper shaft; south end, 15' up from base	None	5.3	0.05			
WR-3	WR	2,600	Lower east dump, associated with lower shaft; 10' south of shaft grate	None	5.8	0.07			
WR-4	WR	500	Lower dump, associated with lower adit; south end	None	6.1	0.06			
WR-5	WR	148	Upper west dump, associated with adit	None	6.6	0.04	22-243-WR-2	09/16/95 1100	T-Metals, ABA
WR-6	WR	385	Lower west dump, associated with discharging adit	None	6.8	0.06			
WR-7A	WR	6,750	Eastern, lower part of site, large dump associated with discharging adit; northwest part	None	< 3.5	0.04	22-243-WR-3	09/16/95 1100	T-Metals, ABA
WR-7B	WR		Eastern, lower part of site, large dump associated with discharging adit; east part	None	5.2	0.05			

* pH readings were taken directly on-site (Kelway Meter).

Comments or deviations from SOPs: 22-243-WR-1 is a composite of WR-1 through WR-4. 22-243-WR-2 is a composite of WR-5 and WR-6. 22-243-WR-3 is a composite of WR-7A and -7B. Background sample was collected from the Nellie Grant site (22-244-SS-1) during the 1993 investigation.

B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes_X_, **No**___, **Number:**_2_ **Identification:**_AD-1 at WR-6 and AD-2 at WR-7_

Filled shafts: Yes___, **No**_X_, **Number:**____ **Identification:**____

Seeps/Springs: Yes_X_, **No**___, **Number:**____ **Identification:**_Several in the area, no identification; none were sampled._

Groundwater wells within 4 miles?: Yes_X_, **No**___;
Number of well logs:_62_

Distance to nearest well used for drinking:
___**<1,000 ft;**___**1,000 ft to 0.5 miles;**_X_**>0.5 miles.**

Sample types: Flowing adits (AD); filled shafts (SH); Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?
Definite____, **Probable**_X_, **Possible**____, **Unlikely**____.
Large uncontained sources; very shallow groundwater (discharging adits and springs; sources have high concentrations of contaminants and low pH.

Approximate Depth to Groundwater:_X_**<25 ft;**___ **25 - 100 ft;**___ **>100 ft.**

Other observations/notes:_N/A_

GROUNDWATER INVENTORY FORM

SAMPLERS: Tuesday, Flammang, Liebelt

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SOURCE	FLOW* cfs/gpm	pH SU	SC $\mu S/cm$ @ 25°C	Eh mV	Temp °C	ALK. mg/L as $CaCO_3$	Depth ft	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
AD-1	AD	Discharging adit associated with WR-6	< 1 gpm (E)	7.49	117.5	250	8.9	16	N/A	22-243-AD-1	09/15/95 1800	T-Metals, TDS, Hardness, Cl, SO4
AD-2	AD	Discharging adit at WR-7	10 gpm (E)	3.90	565	360	6.7	0	N/A	22-243-AD-2	09/15/95 1850	T-Metals, TDS, Hardness, Cl, SO4

FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/run-off) and directions on sketch maps.

Flowing streams: Yes X , No ___, **Name(s):** Unnamed tributary of Lump Gulch at lower (east) part of site

Dry streambeds: Yes X , No ___, **Name(s):** Unnamed tributary of Lump Gulch at upper (west) part of site

Other surface water: Yes ___, No X , **Name(s)/Description:**

Waste materials within any floodplain: Yes X , No ___ **Source ID(s):** WR-7

Approximate Flood frequency? X 1 yr, ___10 yr, ___100 yr

Estimated seasonal flow of stream(s) (cfs/gpm)? 15 gpm
High Flow: 0.1 cfs , **Average Flow:** 25 gpm

Distance between waste source(s) and nearest surface water body (ft)? 0 feet

Surface water draining onto or through waste sources: Yes X , No ___,
Describe: AD-2 flows over and seeps through WR-7. AD-1 flows onto and seeps into WR-6.

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)
Wetlands, limited possible fishery, irrigation, agriculture

Observed erosional/sedimentation/stream turbidity problems? Yes X , No ___. **Distance downstream (ft)?** 0-500___; 500-1,000 X ; >1,000___.
Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present)**:** Eroded waste rock in streambed. Iron-oxide staining along adit discharge path and in stream after it enters.

SURFACE WATER INVENTORY FORM

SAMPLERS: Tuesday, Flammang

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SAMPLE LOCATION	pH SU	SC µS/cm @ 25°C	Temp °C	ALK. mg/L as $CaCO_3$	Flow* cfs/gpm	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
SW-1	SW	Downstream of lower site; 40' below WR-7	5.69	140	8.8	0	15 gpm (E)	22-243-SW-1	09/15/95 1850	T-Metals, TDS, Hardness, Cl, SO4
SE-1	SE	Downstream of lower site; 40' below WR-7	N/A	N/A	N/A	N/A	N/A	22-243-SE-1	09/15/95 1850	T-Metals
SW-2	SW	Upstream of lower part of site; above WR-7	6.88	71	8.0	16	15 gpm (E)	22-243-SW-2	09/15/95 1900	T-Metals, TDS, Hardness, Cl, SO4
SE-2	SE	Upstream of lower part of site; above WR-7	N/A	N/A	N/A	N/A	N/A	22-243-SE-2	09/15/95 1900	T-Metals

FLOW: Estimated (E) or Measured (M)?

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

AMD Characteristics:

Presence and abundance of sulfides?	*(SO_3)*
Presence of evaporative salt deposits?	*(ESD)*
Discolored or turbid seepage?	*(SPG)*
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	*(FEOX)*
Presence of burned or stressed vegetation?	*(VEG)*
pH ≤ 5.0	*(pH)*

General Potential for AMD Mitigation:

Area available for treatment (acres)? 10 acres at upper area; < 1 at lower area

Wetlands present: Yes _X_, **No**___, **Describe:** Well below site in Frohner Meadows

Carbonate rocks/soils: Yes___, **No** _X_, **Describe:**___

E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10___; 10-30___; 30-100___; 100-300 _X_**; 300-1,000___; 1,000-3,000___; 3,000-10,000___; 10,000 or greater___; Comments** Town of Rimini

Nearest residence:___<1,000 ft;___1,000 ft - 0.5 miles; _X_ **>0.5 miles.**

For each source (table next page):

Available fine materials? Surface area?

Uncovered and unvegetated? Wet or dry?

Overall dust propagation potential:
observed high moderate low none

ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

SAMPLERS: Tuesday, Flammang, Clark, Liebelt

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LIST)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/HIGH/MODERATE/LOW/NONE)
WR-1	FEOX	Dry	5,400	5,400	Yes	Low
WR-2	FEOX; SO3	Dry	3,600	3,600	Yes	Low
WR-3	FEOX; SO3	Dry	23,400	23,400	Yes	Low
WR-4	FEOX	Dry	3,420	3,420	Yes	Low
WR-5	FEOX; SO3	Partial	900	720	Yes	Low
WR-6	FEOX; SO3	Partial	2,700	2,700	Yes	Low
WR-7	FEOX; SO3; pH	Dry	36,450	35,450	Yes	Low
AD-1	FEOX	N/A	N/A	N/A	N/A	N/A
AD-2	FEOX; pH	N/A	N/A	N/A	N/A	N/A

Notes and Clarifications:

F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes_____, No_X_,
Describe:____________________

Population within 1 mile: 1-10_X_; 10-30___; 30-100___; 100-300___; 300-1,000___; 1,000-3,000___; 3,000-10,000___; 10,000 or greater___;
Comments____________________

Evidence of recreational use on site: Yes_X_, No___, Describe:
Some litter at lower site

Accessibility (check each that apply): X Easily accessible - no fences, gates, or warning signs; ___Moderately Accessible - barbed wire fences, road gated, or signs posted; ___Difficult Access - chain-link fence, road gated and locked, site guarded (does not include locked or manned access points located more than 0.5 miles from the actual site).

Sensitive environments on-site or adjacent to site:
State or National Parks - Yes___, No_X_, Comment________
Wilderness Area - Yes___, No_X_, Comment________
T&E Species Habitat - Yes___, No_X_, Comment________
Bat Habitat - Yes_X_, No___, Comment Possible in shafts

Primary Drainage___; Secondary Drainage_X_; No Information___:
Riparian Habitat Quality - High___, Medium_X_, Low___
Wetlands Frontage - High___, Medium_X_, Low___
Fisheries Habitat and Species Classification - 4
Sport Fishery Classification - 4

G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes_X_, No___, Number_1_, types and locations:
Fenced, open stope (2 shafts have been grated)

Hazardous structures: Yes_X_, No___, Number_2_, types and locations:
Cabins at upper part of site

Unstable highwalls, pits, trenches, slopes: Yes___, No_X_, Number____, types and locations:____________________

Unstable waste piles, impoundments, undercut banks: Yes_X_, No____, Number_1_, types and locations: Stream undercutting WR-7

Fire and/or Explosion hazards: Yes___, No_X_, Explain:________
____

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MDHES/SHWB, Superfund Basics, Overview and Accomplishments of Superfund in Montana 1983-1993, November 1993.

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USGS, Geology and Mineral Deposits of the Jefferson City Quadrangle, Jefferson and Lewis and Clark Counties, Montana, Professional Paper 428, Author Unknown, Date Unknown.

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LABORATORY ANALYTICAL DATA

FROHNER
PA NO. 22-243

Frohner Mine PA# 22-243
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/15/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-243-SE-1	5.9 UJ	375 J	62.3	1.8	789	3.0	5.6	16.5	10400	298 J	1160 J	1200	0.065	5.8	1.0 U	192	NR
22-243-SE-2	7.0 UJ	8.0 J	312	0.88	1030	4.2	6.2	6.4	7500	16.6 J	1010 J	3120	0.048	3.2 U	0.71 U	28.3	NR
22-243-WR-1	16.3 J	6050	52.4	0.56 U	17.6	1.6 U	1.9 U	48.2 J	10700	4250 J	19.1	3.3	0.97	2.4 U	26.6	50.3 J	NR
22-243-WR-2	5.5 UJ	372 J	26.9	0.59 U	36.9	1.7 U	1.9 U	10.9	3660	1410 J	31.7 J	6.8	0.62	3.2	2.8	88.8	NR
22-243-WR-3	5.4 UJ	802	76.4	0.57 U	66.9	1.7 U	1.9 U	9.8 J	8020	261 J	19.7	16.9	0.62	2.4 U	1.1	59.0 J	NR
BACKGROUND	3.4 UJ	10	52.7	1.3	NR	2.23 J	3.15	6.12	6390	21.9	NR	284	0.035 J	2.6	NR	43.6	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potant. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft
22-243-WR-1	0.26	8.12	-1.71	-9.38	0.23	0.01	0.02	0.31	-2.02	-2.02	-4.24	6.33	-10.05	-21.10
22-243-WR-2	0.08	2.50	-0.86	-3.36	0.07	0.01	<0.01	0.31	-1.17	-1.17	-2.46	1.95	-3.52	-7.38
22-243-WR-3	0.12	3.75	-3.90	-7.65	0.11	0.01	<0.01	0.31	-4.21	-4.21	-8.84	2.89	-8.49	-17.83

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Al (ug/L)	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
22-243-SW-1	853 J	2.7 UJ	35.6	19.4	7.3	12700	9.6 U	10.9 U	13.5	1730	15.4	2020	2460	0.16 U	13.9 U	0.80	40.1	1420
22-243-SW-2	37.1 UJ	2.7 UJ	1.2 U	16.6	0.064 U	8780	9.6 U	10.9 U	4.4 U	40.4	0.58 U	1180	5.2 U	0.16 U	13.9 U	0.23	26.8	7.6 U
22-243-AD-1	199 J	2.7 UJ	120	55.5	6.9	12800	9.6 U	10.9 U	22.1	1920	112	1240	610	0.16 U	13.9 U	0.31	37.0	1060
22-243-AD-2	1350 J	2.7 UJ	1440	17.0	36.1	24900	9.6 U	33.0	20.8	33200	459	4550	10000	0.16 U	25.1	1.8	80.9	5590

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids		CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
22-243-SW-1	119	<	5	60	NR	NR
22-243-SW-2	51	<	5	7	NR	NR
22-243-AD-1	106	<	5	41	NR	NR
22-243-AD-2	297	<	5	178	NR	NR

Legend

SE-1- 40 feet downstream of WR7 in Lump Gulch.
SE-2- Upstream of WR7 in Lump Gulch.
AD-1- Discharging adit associated with WR6.
AD-2- Discharging adit associated with WR7.
SW-1- Same as SE-1.
SW-2- Same as SE-2.
WR-1- Composite WR1, WR2, WR3, and WR4.
WR-2- Composite WR5 and WR6.
WR-3- Composite WR7A and WR7B.

XRF ANALYSIS RESULTS

FROHNER
PA NO. 22-243

Mine Name: Frohner PA No. 22-243
XRF Field Analyses
Results in PPM

XRF SAMPLE I.D.	CrHI	K	Ca	TI	CrLO	Mn	Fe	Co	Ni	Cu	Zn	As	Se
22-243-WR1		39646	1365.2 *	1000			16215				63.949 *	3131.2	22.212 *
22-243-WR2		34625	1062.8 *	916.04	248.32 *	419.08 *	11488				169.05 *	768.86	26.079 *
22-243-WR3		38920	1006.6 *	751.49 *		426.94 *	30615	631.8 *			105.2 *	15900	54.897 *
22-243-WR3-DUPL		42001	1220.4 *	865.5			31153	428.17 *			141.41 *	16286	42.65 *
22-243-WR4		34862	1551.5	1143.9		365.14 *	14092				169.84 *	637.94	
22-243-WR5		36634	1184.1 *	412.79 *		300.86 *	11254				134.7 *	258.04 *	21.673 *
22-243-WR6		45219	1085.6 *	551.35 *		402.3 *	8019.4				171.55 *	491.15	24.409 *
22-243-WR7A		28418	1261.7	1207.4		400.19 *	7423				137.74 *	1090.2	
22-243-WR7B		37600	1248.4 *	1145.8		438.02 *	34418				179.43 *	1888.9	21.588 *
22-243-WR1-COMP		41114	995.52 *	1021.9		455.04 *	20911				114.67 *	7088.5	38.223 *
22-243-WR2-COMP		48145	1090.9 *	728.23 *			9340.1				182.72 *	353.84 *	
22-243-WR3-COMP		28076	1250.1	793.94 *			14997				147.33 *	1402.7	

XRF SAMPLE I.D.	Sr	Zr	Mo	Hg	Pb	Rb	Cd	Sn	Sb	Ba	Ag	U	Th
22-243-WR1	37.24	115.65	22.103 *		1904.2	283.82				402.48	121.34 *		
22-243-WR2	20.099 *	118.04			4708.2	264.84				210.14	110 *		
22-243-WR3	20.186 *	105.87	11.366 *		4220.3	251.47				299.39	155.48 *		
22-243-WR3-DUPL	24.375 *	102.68	11.625 *		4350.9	246.99			106.65 *	299.62	152.63 *		
22-243-WR4	51.197	157.21			1538.9	231.3				449.96	89.055 *		
22-243-WR5	18.627 *	94.926	53.765		735.29	317.57				390.78			15.993 *
22-243-WR6	11.313 *	96.275	14.728 *		1294.8	313.28				302.49	95.879 *		13.733 *
22-243-WR7A	73.318	150.39	7.5112 *		237.93	125.35				349.05			
22-243-WR7B	68.581	136.74			280.32	305.67				701.97			12.436 *
22-243-WR1-COMP	26.387 *	112.17	11.038 *		2819.3	293.2				376.48	94.46 *		
22-243-WR2-COMP	15.3 *	103.64	27.657		1592.2	309.29				335.11			
22-243-WR3-COMP	76.687	177.13			375.28	159.53				561.22			

ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS) SCORESHEET

FROHNER
PA NO. 22-243

MDEQ AMRB/PIONEER 1/12/96

AIMSS SCORESHEET

SITE NAME: FROHNER
PA NUMBER: 22-243

LINE NO.				
		GROUNDWATER PATHWAY		
1	GW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A		CONTAINMENT		20
3B		GW DEPTH		20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	400
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	400
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	55.567
6	GW - TARGETS	WELLS - 1 MI. x 2.5		0.0
7		WELLS - 1 TO 4 MI		62
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	62.0
10		**GROUNDWATER SCORE**	LINES 4 x 5 x 9	1378062
		SURFACE WATER PATHWAY		
11	SW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		300
12		EXCEEDENCES		100
13A		CONTAINMENT		20
13B		DISTANCE TO SW		20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	400
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	800
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	58.097
16	SW - TARGETS	DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		1
18		WETLANDS		10
19		FISHERY		1
20		RECREATION		5
21		IRRIGATION/STOCK		2
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 THRU 22	19
24		**SURFACE WATER SCORE**	LINES 14 x 15 x 23	883074
		AIR PATHWAY		
25	AIR - LIKELIHOOD OF RELEASE	OBSERVED RELEASE		0
26A		CONTAINMENT		10
26B		DISTANCE TO POPULATION		5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	50
27		LIKELIHOOD SCORE	LINES 25 + 26C	50
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	1.199
29	AIR - TARGETS	POPULATION - 4 MILES		100
30		NEAREST RESIDENCE		0
31		WETLANDS		10
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 THRU 33	110
35		**AIR PATHWAY SCORE**	LINES 27 x 28 x 34	6595
		DIRECT CONTACT PATHWAY		
36	LIKELIHOOD OF EXPOSURE	OBSERVED EXPOSURE		50
37A		ACCESSIBILITY		20
37B		DISTANCE TO POPULATION		5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	100
38		LIKELIHOOD SCORE	LINES 36 + 37C	150
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	1.151
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE		1
41		NEAREST RESIDENCE		0
42		RECREATIONAL USE		2
43		TARGETS SCORE	SUM LINES 40 THRU 42	3
44		**DIRECT CONTACT SCORE**	LINES 38 x 39 x 43	518
45	**TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE**	(LINES 10 + 24 + 35 + 44) / 100,000		**22.68**

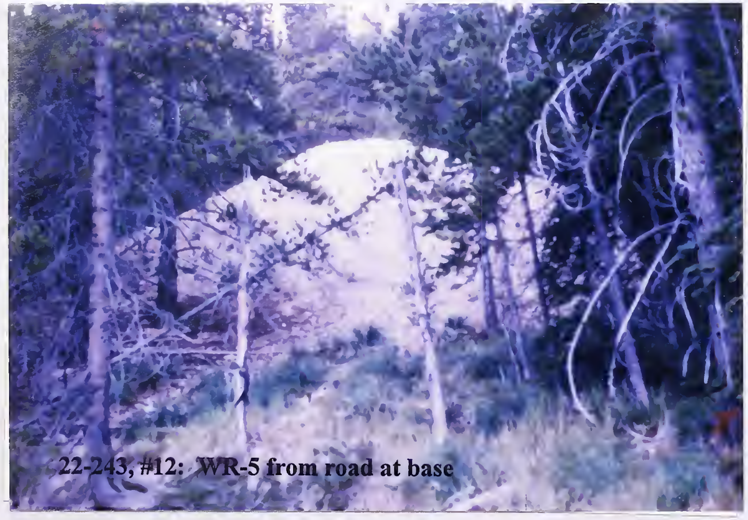
			SITE NAME: PA NUMBER:	FROHNER 22-243
LINE NO.		**SITE SAFETY**		
1	THREAT	ACCESSIBILITY		20
2		OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	50
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	0
5		HAZ. STRUCTURES	40 EA.	80
6		EXPLOSIVE HAZARD		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 THRU 7	130
9		POPULATION - 1 MILE		1
10	TARGETS	NEAREST RESIDENCE		0
11		RECREATIONAL USE		2
12		TARGETS SCORE	SUM LINES 9 THRU 11	3
13		**SITE SAFETY SCORE**	(LINES 1 x 8 x 12) / 1,000	**7.80**

22-243, #8: WR-1 facing east

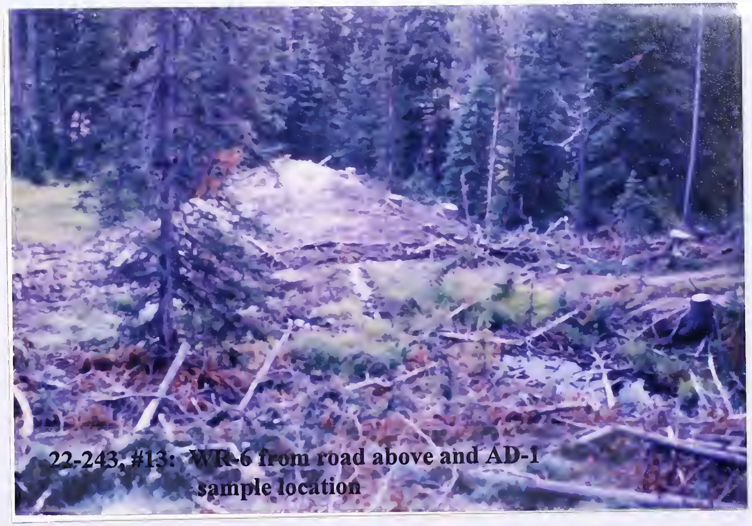
22-243, #9: WR-2 from base

[illegible]-4 from base

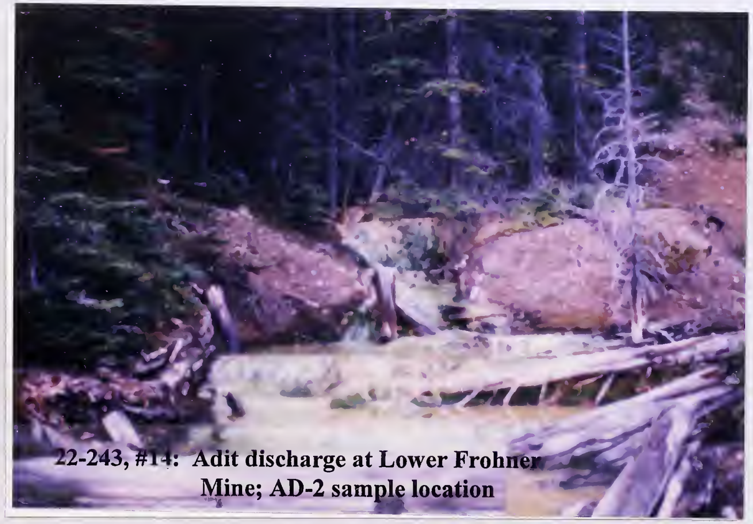
22-243, #11: WR-3 from east side of dump



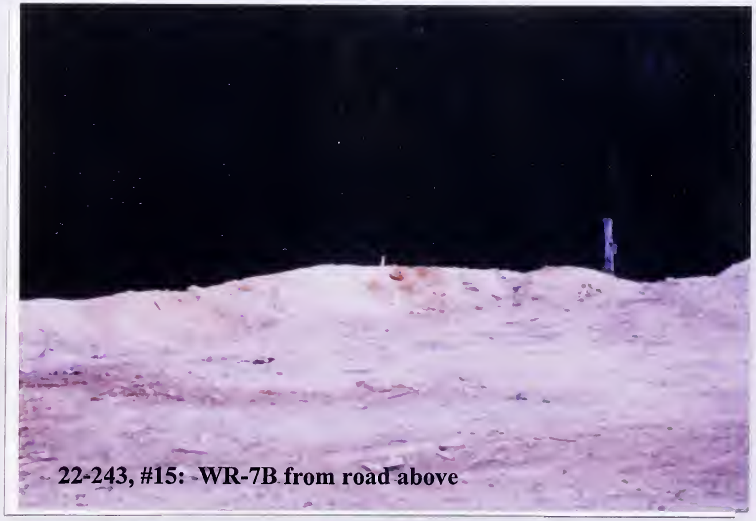
22-243, #12: WR-5 from road at base



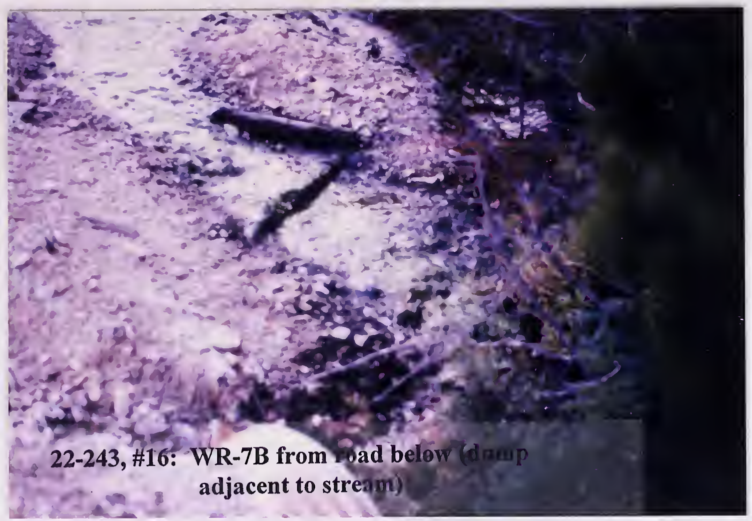
22-243, #13: WR-6 from road above and AD-1 sample location



22-243, #14: Adit discharge at Lower Frohner Mine; AD-2 sample location

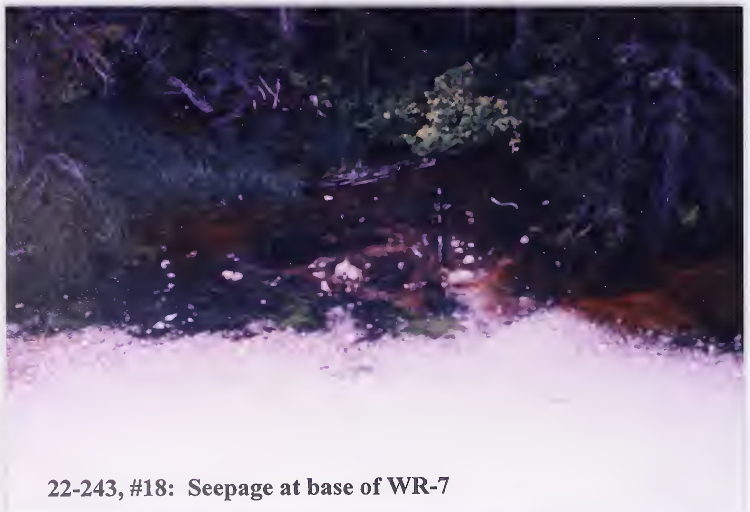


22-243, #15: WR-7B from road above



22-243, #16: WR-7B from road below (dump adjacent to stream)

22-243, #17: WR-7A from road below



22-243, #18: Seepage at base of WR-7